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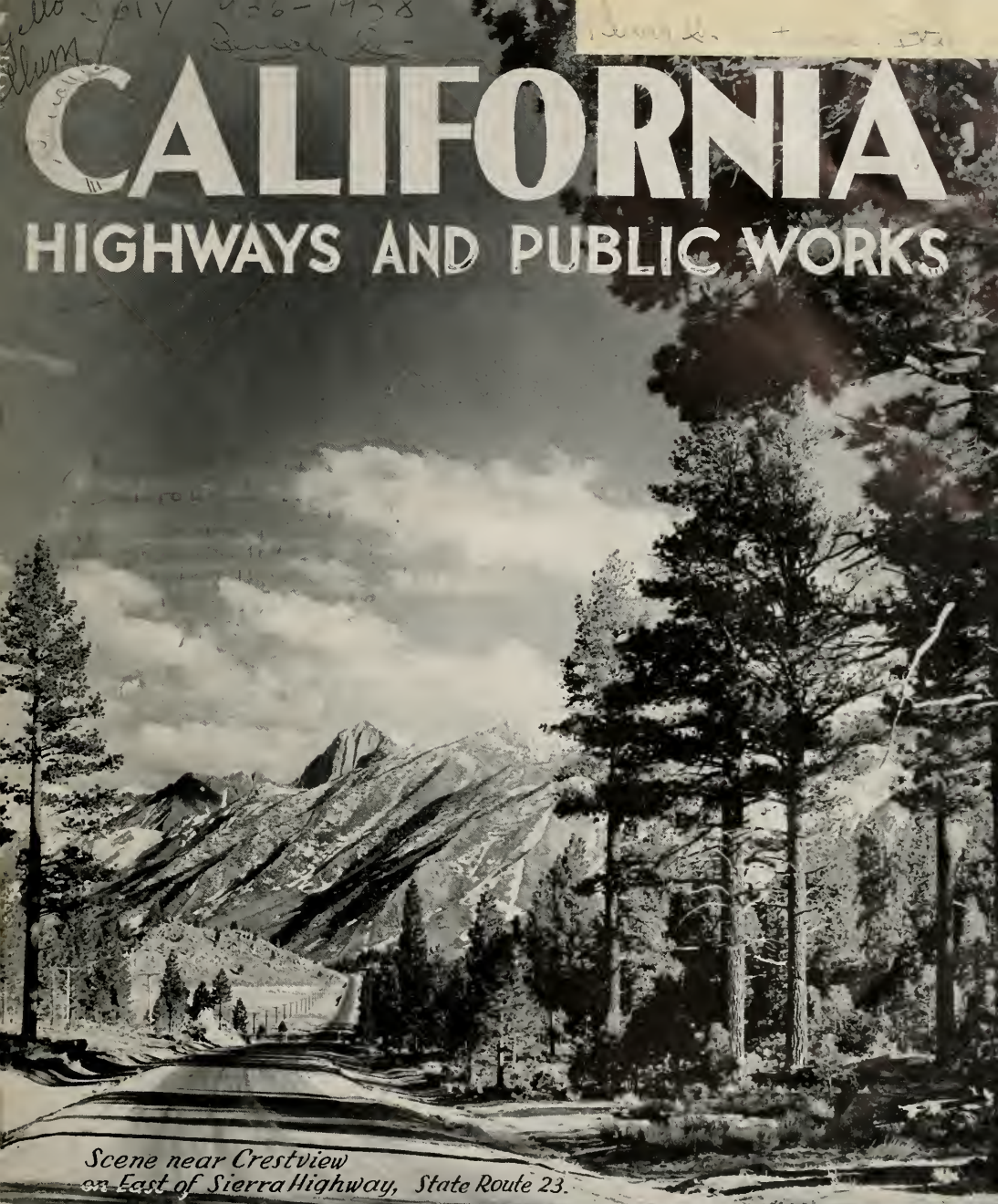
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CALIFORNIA

HIGHWAYS AND PUBLIC WORKS



Scene near Crestview on East of Sierra Highway, State Route 23.

Official Journal of the Department of Public Works

JULY 1936

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways of the Department of Public Works, State of California

EARL LEE KELLY, Director C. H. PURCELL, State Highway Engineer JOHN W. HOWE, Editor

Published for information of the members of the department and the citizens of California

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Highway Budget Revised for Last Half of the Biennium

By GEORGE T. McCOY, Assistant State Highway Engineer

THE close of the first half of the current budgetary biennium, composed of the 87th-88th fiscal years covering the period from July 1, 1935, to June 30, 1937, finds the Division of Highways in a more favorable financial position than was anticipated one year ago at the outset of the biennium.

Some revision of the State Highway biennial budget has been necessary because revenues from the tax on the sale of gasoline have exceeded estimates made at the time of the preparation of the budget by about 14 per cent.

For the original budget the State's share of gas tax revenue was estimated at $46,500,000 for the biennium. From revenues received during the first half of the biennium it has become evident that the total of the State's share of the gasoline tax will amount to approximately $53,000,000 during the biennium.

Of this $6,500,000 increase, statutory allocations to cities will amount to approximately $1,625,000, leaving about $4,875,000 for State Highway work additional to the funds on which the original budget was based. In conformity with the requirements of the Breed Act, and its amendments, this amount has been segregated in the proper proportions to the forty-five northern counties and the thirteen southern counties for construction on State primary and secondary routes, and has been voted to specific construction projects by the California Highway Commission.

There was a period when it appeared doubtful that additional projects could be provided for with these funds as, at the beginning of the last session of Congress, the President recommended that appropriation of Federal funds for the 1937 portion of Federal Aid provided under the Hayden-Cartwright Act be postponed. Such an action would have meant a loss to California of $4,751,700 which had been included for proposed projects at the time the original State Highway budget was prepared. The appropriation was, however, passed by Congress and approved by the President on June 4, 1936.

The total regular Federal Aid accruing to California under the provisions of the Hayden-Cartwright Act, and upon which the State Highway budget was based, amounted to approximately $9,500,000 for the biennium. This amount together with the $15,200,000 apportioned to California from Works Program Highway Funds and Works Program Grade Crossing Funds makes a total of approximately $24,700,000 for State Highway expenditures for the period from July 1, 1935, to June 30, 1937, for which reimbursement from the Federal Government is expected.

This total amount was allocated to major construction projects and at the present time the work has been completed or is under way on all but a portion of the projects proposed to be financed with the aid of the funds recently appropriated by Congress.

The intensive construction program which State and Federal funds have made possible for the biennium has resulted in the necessity of an adequate cash balance for the conduct of the large number of contracts involved in the work.

On June 1, 1936, cash in the State Treasury to the credit of the State Highway Fund amounted to the sum

(Continued on page 15)

How California Ranks in Highway Construction Among 48 States

Type of road	Miles	Position with respect to 48 states
Total State Highway System	13,956	6
Total Improved Roads in State Highway System	12,617	6
Gravel Roads (oil treated and untreated)	5,657	4
Paved Roads	2,301	5
Bituminous Mix Surface	970	30
Oiled Earth Roads	2,473	3
Graded Roads	1,143	10
Average per Vehicle Revenue of $23.51		46

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New Cuesta Grade Will Eliminate 63 Curves

By
L. H. GIBSON
District Engineer

FOR the past several years, especially since the era of the fast moving automobile and heavy truck travel, the winding Cuesta Grade highway over the Santa Lucia Mountains, just north of San Luis Obispo and on the Coast Highway (U. S. 101), has presented an unwelcome interruption to the motorist traveling El Camino Real in an otherwise comfortable and easy trip.

The Santa Lucia Mountains which range northwesterly across the central coast section of the State have presented, as State history will verify, a definite problem to the varying stages of transportation from the days when the padres toiled afoot to today's modern car. The most feasible and direct route through this barrier lay northeasterly from where the city of San Luis Obispo now stands, following up from the south via San Luis Creek and thence down the northerly side into the upper reaches of the Salinas Valley.

MOUNTAINS PROVED BARRIER

It was at the southern foot of this grade that in 1772 Father Junipero Serra established Mission San Luis Obispo, the fifth of the California Missions, that it might not only serve as a school and church for the education and conversion of the Indians, but also as a resting place before starting the arduous ascent of the Cuesta Grade.

These same mountains had their influence in retarding the progress of the coast line of the Southern Pacific Railroad. The railroad was completed from San Francisco to Santa Margarita on the northerly side of the grade in 1889, but it was not until 1894 that the line, at great cost, was carried over the grade and down the long southerly slope to connect with the northerly end of the line from Los Angeles and Santa Barbara.

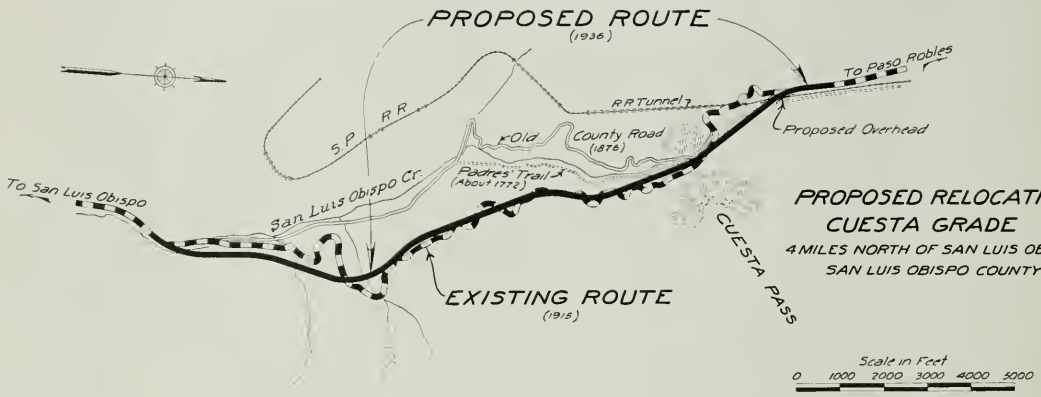
WAGON TRAIL BUILT

During the very early period the first demand for a road was felt and there still is visible in the bottom of San Luis Creek the first Cuesta Grade highway. This was merely a wagon trail, steep and rugged, but allowed the horse and wagon to transport supplies and gave a connection to the railroad for the early day stage coach. Old timers relate many thrilling experiences on this first road.

In 1876, the county of San Luis Obispo completed the first constructed highway over the Cuesta Grade, which was used until 1915 when the present grade was built. This county highway was a winding road with steep grades, unsurfaced and about 12 feet wide, and was constructed along the more steep and rugged westerly side of San Luis Canyon. This road is still in existence and travelable, and is sometimes driven over by local residents as a matter of diversion.

In the early California State Highway program, about 1912, the construction of a main Coast road from San Francisco to Los Angeles was proposed, and the contract for grading to a 24-foot width and surfacing with gravel the present Cuesta Grade Highway along the easterly slope of the canyon was completed in 1915. The following year this road was oiled and remained that type until 1923 when a 21-foot width of 5"-6" P. C. C. pavement with a curb along each edge was laid.

This present road, although adequate at the time it was constructed and for sometime thereafter, is sadly lacking in present day standards to satisfy the requirements of the larger, heavier and faster traffic that has now developed. It is now the one remaining annoyance to the motorist using the Coast Highway, especially when he is bottled up behind slowly moving truck traffic without opportunity to pass safely because of limited sight distance.



FUNDS APPROPRIATED

The California Highway Commission has appropriated funds to cover the cost of rebuilding the Cuesta Grade to line and grade consistent not only with the needs of today's traffic but anticipating requirements for many years to come.

Preliminary investigation and surveys have been under way for several months to determine the most feasible and economic location consistent with

(Continued on page 23)











Cuesta Grade Realignment Project. No. 1—Existing highway showing numerous sharp curves. Nos. 2-3—Traffic congestion behind slow moving vehicles. Nos. 4-5—Boring and testing to determine earth structure on new alignment.



JIBBOOM STREET GRADE SEPARATION AND BRIDGE APPROACH PROJECT IN SACRAMENTO

By Glenn L. Enke, Associate Bridge Designing Engineer

A COMBINED grade separation and bridge approach project now under construction in the city of Sacramento is another instance of the cooperation of State, city and the Federal government in providing a much needed highway improvement that in addition to enhancing transportation facilities also insures safety for motor traffic at present obliged to sort of run the gauntlet of moving trains across a dozen tracks of a busy railroad yard.

Located in an area of the city near the confluence of the Sacramento and American rivers, an historic thoroughfare now referred to as Jibboom Street extends from the close vicinity of the I Street or Southern Pacific bridge, across this triangular area to a bridge over the American River.

HISTORIC OLD STREET

The name "Jibboom Street" recalls to old Sacramentans an earlier day when Jibboom Street or Water Street, now a part of the Southern Pacific Railroad yards, fronted on the Sacramento River and provided a place of business for commercial fishermen to tie up their boats and display their wares. It affords a short cut for traffic from the lower business section of the city across the main line and yard tracks of the Southern Pacific to the American River bridge connecting via the Garden Highway to Yuba City and Marysville with U. S. 99 E and via North Sacramento with the Auburn-Lake Tahoe Highway, U. S. 40.

No less than forty regular train movements occur at street grade across this yard every twenty-four hours in addition to a vastly greater amount of freight engine switching.

The Jibboom Street grade separation unit of the project which will be built by the State provides for a connection with a new approach to the I Street bridge from Third Street which will be built by the city of Sacramento.

The Jibboom Street unit will be financed with U. S. Works Program Grade Crossing funds and the city will finance the Third Street aproach with a Federal loan or gas tax moneys accruing to the municipality.

Plans and specifications for both units were prepared by the State Division of Highways and the entire improvement will cost approximately $300,000. Of this amount $169,250 represents the total cost of the Jibboom Street unit for which the contract has already been awarded.

IMPROVES BRIDGE APPROACH

In addition to the benefits to be derived from the grade separation feature, the new combination structure will greatly improve the Sacramento entrance to the I Street bridge used jointly by the railroad and vehicular traffic, the latter being accommodated on the upper bridge deck. The existing vehicular approach from I Street is only 18 feet in width between curbs with two sharp angle turns and an abrupt change in grade at top and bottom. The new approach from Third Street will have a width of 34 feet and provide over



500 feet of sight distance to oncoming vehicles.

This approach to the I Street bridge forms a wye with the Jibboom Street unit, 24 feet in width, coming from the north parallel to the buildings of the Old Pioneer Mill. Maximum gradient is 6 per cent, no greater than the present approach. This wye is perfectly level, and of ample size to prevent traffic congestion.

PEDESTRIAN WALKS PROVIDED

Two 5-foot sidewalks are provided on the Third Street unit, one of them connecting into the present sidewalk along the south side of I Street bridge, the other continuing around and running north the full length of the Jibboom Street unit. No sidewalk will be constructed along the west side of this unit, as available side clearance between the structure and Old Pioneer Mill is barely that required for train operation. The north side walk of the I Street bridge will be extended around the wye, ending at the head of a steel stairway leading down into the railroad yards. A series of 22 light standards will be placed throughout the structure to provide adequate illumination for night travel.

A feature of the design problem was to provide access across the railroad yard by the present road for the use of trucks stopping at Old Pioneer Mill. This road crosses under the Third Street unit at Second Street, diagonals across the railroad yard, and runs directly underneath the Jibboom Street unit for 550 feet.

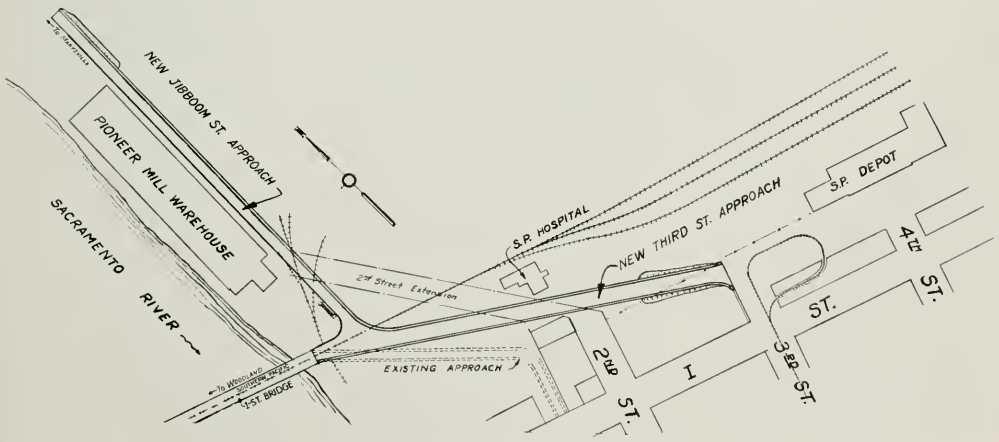
RIGID FRAME CONSTRUCTION

In these areas, therefore, no diagonal bracing of any kind could be used between columns, and resort was had to what is called a "rigid frame" type of construction, wherein the columns and cross member supporting the bridge deck are rigidly fastened together and act as a unit in resisting vertical and horizontal forces. This construction was accomplished by using structural steel members resting upon concrete pedestals and timber pile foundations, and tied together underground to insure an adequate horizontal restraining force required with this type of layout. Both approach units, of steel and concrete construction throughout, are designed to resist earthquake forces.

MINIMUM OF INTERFERENCE

Underground utility lines complicated the layout problem, and in most instances practically dictated the loca-

(Continued on page 27)



State-Wide Highway Planning Survey

By T. H. DENNIS, Maintenance Engineer

TO DATE in approximately forty states the Bureau of Public Roads has initiated state-wide highway planning projects. Thos. H. MacDonald, Chief of the Bureau of Public Roads, in commenting upon the neecssity for such surveys, stated:

> "Developments of the last year, especially the growing demand for improvement to secondary roads, have moved rapidly to the point where throughout the country it has been urgently necessary from the national point of view, that the factual material to be developed by such planning surveys be made available as promptly as possible. . . ."

In California the growth of the movement for the improvement of secondary roads is indicated in the distribution of Federal highway appropriations for the past year. Of the $7,486,362 appropriated for the Federal grade separation program and the Federal Emergency appropriation of $7,747,928, approximately 29 per cent has been for county roads and city streets which are not part of the primary road system of the State.

PURPOSES OF SURVEY

The results of the surveys in the various states are therefore to be employed as required to accomplish the following ends:

1. **Select an integrated highway system to include all roads to be improved within the next twenty years, and indicate priority of improvement.**
2. **Record the present condition of all parts of the selected mileage in respect to traffic serviceability, and indicate the amount, kind, and cost of further improvement required to reach fully satisfactory serviceability.**
3. **Budget highway appropriations of a considerable future period, and indicate sources from which necessary funds should be and can be obtained, properly related to benefits conferred.**

The California State-Wide Highway Planning Survey, which has as its aim the accomplishment of these objectives, is being financed by Federal funds approximating $228,000. The California project as set up is somewhat less costly than the programs of other states of comparable size or road mileage. This is due in no small measure to the fact that many basic data obtained in the California Highway Transportation Survey of 1934 are being used in the present survey.

COMPRISES FOUR STUDIES

The project is divided into four studies. One study, the road inventory, has already commenced. Plans for two other studies, a traffic census and a truck and bus survey are nearing completion, while those for the fourth, a financial study, are in progress.

The road inventory is confined to public roads traversable by motor vehicles. Tentative determination of whether a road is public or private is being based upon the criteria of maintenance and use, so that there are then two general classes of roads to be considered.

(a) **Roads maintained by the public for public use; and**
(b) **Roads maintained by private individuals for public use.**

In the latter category are toll roads, toll bridges, ferries, etc. Each of these general classes will in turn be further analyzed to show the interlocking interests of various governmental units in construction and maintenance.

COMPREHENSIVE ROAD INVENTORY

The road inventory will deal with the physical condition of the roads and with the development adjacent to them.

With respect to their physical condition, roads will be characterized as to alignment, gradient and drainage, the degree of improvement in roadbed and type of surfacing, width of road, and existence of sidewalks. Records will be made of structures—bridges, overpasses and underpasses—their type, width, length, vertical clearance, and general condition.

Particular attention will be paid to railroad grade crossings. The alignment of railroad tracks and highway approach gradients will be noted. Crossings will be classified according to the sight distance available from the highway. Existing signs and other devices designed to warn highway traffic of the tracks will also be logged.

POPULATION ESTIMATES POSSIBLE

In recording the development contiguous to the roads, farm units, industrial and commercial enterprise, public utilities, residences, places of congregation, etc., will be noted. From these data it will be possible to estimate the distribution of population for comparatively small areas or mileage of road. An estimate of the seasonal population of recreational areas can be made in the same manner.

The second major study of the survey will consist of special traffic counts covering the rural roads—those roads outside of corporate areas. On the county roads counts will generally be of eight hours duration at a single station, and the vehicles will be classified as to type and hour of passing. These special counts, which will be made throughout the year, will be in addition to the counts made regularly on the State highway system.

Plans also call for the use of traffic counts which have been made by several of the counties. It is estimated that when all available data are assembled, the final results will show an average of approximately one traffic station for ten miles of county road. This average is comparable to that for the State highway system.

TRUCK AND BUS SURVEY

To supplement the traffic counts, plans are being made to conduct a truck and bus survey at a sufficient number of points to distinguish definitely the characteristic movements of freight and passengers, including rural mail and school bus movement, in various areas and roads throughout a period of a year.

It is anticipated that a year will be required to complete the field work of the planning survey. The administrative personnel for the project has been drawn from the regular staff of the Division of Highways, and as is the rule on Federal cooperative projects, all other positions are being filled through the U. S. Reemployment Service.

FEEDER-ROAD WORKERS FIND BONES OF MASTODON BURIED 200,000 YEARS AGO

EXCAVATING for a road of modern times, engineers of the State Division of Highways and contractors, engaged in building a section of the Imperial Highway Feeder Route project just south of La Habra near the Los Angeles-Orange County line recently unearthed fossils of an era of 200,000 years ago.

Bones of animals that lived in the early Pleistocene era were dug up and in accordance with standing orders of the Division of Highways in such cases were carefully collected for scientific study by the resident engineer in charge of the construction work F. R. Pracht.

The Division of Highways turned the bones over to Dr. Chester Stock, Professor of Paleontology at the California Institute of Technology, and Dr. H. Anson Wilde, Curator of Vertebrate Paleontology of the Los Angeles Museum.

BONES OF MASTODON

These scientific gentlemen gave it as their opinion that among the more important discoveries were the teeth, pelvis bone, shoulder blades and shoulder bones of a giant mastodon; the teeth, leg bones, ribs and vertebrae of an ancient species of horse; the vertebrae and other bones of a ground sloth; the hind leg of an early bison and several miscellaneous finds including sharks' teeth, bird bones, fish vertebrae and land snail shells.

Dr. Stock set the age of the bones as beginning some time in the early Pleistocene era, 200,000 years ago.

"The discovery is significant," he said, "in that some of the bones are of different ages and some may be as much older as 100,000 years than the others.

REPORTED TO ENGINEER

Men employed by Charles Reynolds, superintendent for R. E. Campbell, contractors, made the finds and Mr. Reynolds immediately reported the matter to Resident Engineer Pracht.

From notes written by Dr. Stock and compiled by Dr. Wilde the following report on the finding of the mammalian fossils has been made a matter of scientific record:

"The section of the deposits exposed by the road cuts shows the presence of cross-bedded sands and gravels, evidently laid down in prehistoric time in a series of stream channels.

"The fossils themselves are scattered and for the most part fragmentary. Some show greater wear than others and appear to indicate that not all the material accumulated at one time. A single tooth of a horse and several pieces of bone are water worn and have every appearance or having been transported for some distance. The tooth represents possibly the genus Plesippus, a type of horse more primitive than the living and later Ice Age species of horses, and found generally in the very early stages of the Ice Age or for that matter in the Pliocene as well.

"Geologists tell us that Pleistocene or Ice Age deposits are exposed to the north of the fossil occurrence along the southern front of the Puente Hills. It is therefore quite possible that a stream flowing southward from the Puente Hills in later Ice Age time may have eroded some of these deposits and their entombed organic remains, carrying them to the place of their present find.

"In addition to this material better preserved specimens representing horse, mastodon, ground sloth and bird (turkey) may represent primary rather than secondary accumulation and may date from a later stage of the Ice Age."



Fair P. W. A. employees exhibit Ice Age fossils including bones of mastodon and Plesippus horse excavated on highway project in Orange County.

TOWER BRIDGE WINS NATIONAL AWARD

By EVERETT L. WALSH, Associate Bridge Engineer

FOR the second time in consecutive years a California bridge, designed by the State Division of Highways and built by the Department of Public Works, has won an award in the annual national competition held in New York by the American Institute of Steel Construction, Inc., for the most beautiful bridge built during the past year.

This honor was won by the Tower Bridge spanning the Sacramento River at Sacramento which was accorded second place in Group B, including bridges costing between $250,000 and $1,000,000. Group A included bridges costing $1,000,000 or more, and Group C those costing less than $250,000. A total of thirty-one bridges entered the contest.

A similar award in 1935 was won in Group C by the Eel River Bridge, a continuous steel girder structure on State Route No. 1, Redwood Highway, at Smith Point in Humboldt County.

The Tower Bridge award brings additional honor from the fact that this lift span structure entered into competition with bridges of all other types, and never before has a lift bridge been judged comparable in harmony of outline and proportion with arch and suspension bridges because the inherent graceful and symmetrical lines of the latter types have always been considered the most beautiful.

NOTED MEN ON JURY

Californians may well be proud, therefore, in having the most beautiful lift bridge in the United States. The awards were made by a jury of nationally known engineers and architects consisting of Messrs. Robert D. Kohn and Arthur Loomis Harmon, architects of New York; Professor William J. Krefeld of the College of Engineering, Columbia University; Mr. Howard C. Baird, consulting engineer of New York; and Mr. Kenneth Hayes Miller of New York, one of America's best known artists.

Records on the early Egyptian monuments prove that bridges were built during the time of Rameses II, 1350 B. C. In the days of King Arthur and his Knights of the Round Table, movable bridges were used as a protection against attack, by having drawbridges over moats around the castles.

The earliest lift bridges in the United States were located along the Erie Canal and were constructed in 1874. As population and water borne commerce increased, it became necessary to increase the size and efficiency of movable bridges. The design of such bridges has kept pace with the development of steam, gasoline and electrical power until today we have large fast moving types of bridges which meet the needs of modern necessity.

290-FOOT LIFT SPAN

The Tower Bridge at Sacramento represents all that is modern in engineering skill and bridge design. The bridge is 737 feet long with a roadway width of 52 feet and two sidewalks four feet wide. A roadway thirteen feet wide, protected by concrete curbs, is provided for the Sacramento Northern Railroad tracks.

The bridge consists of steel spans resting on concrete piers and abutments. The center lift span is 209 feet long and is supported by towers 160 feet high. West of the lift span is one 193-foot steel truss span and four 34-foot steel girder spans. East of the lift span is one 167-foot steel truss span and one 30-foot steel girder span. The overhead clearance of the lift span provides a maximum clearance above high water of 100 feet and a vertical clearance between fenders of 172 feet.

An advantage of this type of bridge is that it is very seldom necessary to raise the lift span to its fully raised position. The majority of vessels can pass under the structure when the lift span is only partially raised and thus avoid undue delay. The bridge can be fully opened and closed in approximately one and one-half minutes. The old bridge which was replaced at this location required six minutes to open and close completely.

The lift span mechanism is operated by power transmitted to the operator's house on the lift span by submarine cables placed at a minimum depth of 10 feet below the streambed. Flexible cables with sufficient slack to provide for the continuous flow of electrical energy when the lift span is raised to its maximum height are located in the towers.

In addition to the electric motors which provide the power for lifting the bridge, there is also an auxiliary gasoline motor which operates an electric generator. In case of a power failure, or if the electrical transmission line is broken for any reason, the gasoline motor will be ready to furnish power at a moment's notice.

The old bridge was built in 1910 at the same location, at the foot of M Street. It had long been an eyesore to the people of the State who entered Sacramento from the west. M Street, the Pennsylvania Avenue of California, runs directly into the State Capitol, which is flanked by the new Capitol Extension buildings and Capitol Park. It was unimpressive, to say the least, to have such an antiquated structure as the gateway to the beautiful capitol buildings and grounds. When the need for a new bridge became an absolute necessity due to traffic requirements, popular sentiment demanded that every effort be expended to design a structure which would be unexcelled in architectural and engineering beauty and thus conform to its natural setting.

NOVEL TOWER DESIGN

Simplicity is the chief characteristic of the bridge architecture. The principal departure from ordinary practice is the plating or covering of the tower truss members by steel plates which give the appearance of simplicity in mass. The plates cover the intricate lacing and cross members and produce a modernistic straight line effect which is pleasing to the eye.

To produce the illusion of artistically adequate pier size in the substructure and continue the simple straight line effect, the fender structure protecting the main pier has been offset a considerable distance back from the channel and extended the proper distance beyond the edge of the tower. The pier itself is not visible through the fender as the fender extends above the pier and effectively conceals it, thus giving the tower an apparent support of ample size.

This treatment of the fender system was handled in this manner because the plating of the towers creates such

(Continued on page 27)



Tower Bridge at Sacramento, winner of award in annual national competition for most beautiful bridges built last year.

Marlette, California's First State Highway Builder, Was Forced to Borrow Road Funds From Public

IN THESE DAYS when the people of California gladly contribute millions of dollars in gas taxes for construction and maintenance of highways, it is rather difficult to visualize the situation that confronted the State's first road builder, Surveyor General S. H. Marlette, who, in 1855, was forced to advertise in the Sacramento newspapers for a loan of $500 to finance a survey ordered by legislative act for the Emigrant Wagon Road over the Sierra by way of Placerville to Carson Valley, Nevada.

At the first session of the legislature in 1850, before California had been admitted to the Union, a law was passed defining the duties of the Surveyor General. As a member and ex officio Chief Engineer of the Commission of Internal Improvements, he was required "**to make plans and suggestions for improvements of navigation, construction of roads, railroads and canals, preservation of forests, * * * and surveys of boundaries of the State and counties.**"

AN AMBITIOUS PROJECT

Public agitation for a "post road, or other road, from the Sacramento Valley to the Missouri River, by way of Great Salt Lake," resulting in mass meetings of citizens in San Francisco, Sacramento, Marysville, Placerville and other places in 1854 and 1855, finally culminated in the legislature taking action.

It passed a bill creating a commission to consist of the Governor, Secretary of State and Surveyor General, which body was authorized to call for bids for the construction of a wagon road from the valley of the Sacramento over the Sierra to Carson Valley at a cost not to exceed $105,000. Governor Bigler signed the measure April 28, 1855.

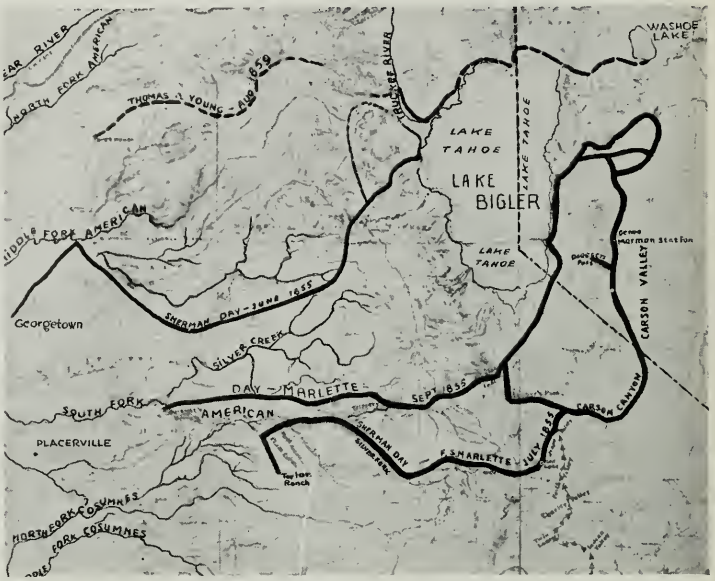
The act provided:

"**The Surveyor General of the State shall cause to be surveyed a good wagon road over the Sierra Nevada Mountains at an expense not to exceed five thousand dollars; and no further liability shall be incurred for this purpose.**"

NO FUNDS PROVIDED

Through an oversight, the legislature failed to appropriate any money for a survey of proposed routes.

Poor Marlette was left with a survey on his hands and no money with which to make it.



Old map showing Marlette and Day surveys made in 1855 for the Emigrant Wagon Road linking Sacramento, Placerville and Carson Valley, Nevada. The road was completed in 1858.

In desperation he called upon public spirited citizens for help. He wrote in one of his official reports:

"**On the 17th of August, 1855, finding it impossible to comply with the requirements of the Wagon Road Act, in a mode commensurate with the importance of the same, in the vain hope of obtaining assistance from some ardent friend of the road, the following advertisement was inserted in Sacramento papers:**

"**'Wanted immediately, on the credit of the State, $500 to enable the undersigned to complete the explorations for the Emigrant Wagon Road. Any gentleman who is willing to advance the above named sum and will signify the same, will be called upon immediately by the undersigned.**

S. H. Marlette
Surveyor General'."

"**Two gentlemen,**" **General Marlette recorded, "called to inquire what security could be given for the above named amount, to which I replied: 'The justice and liberality of the next legislature'.**"

The Surveyor General then appealed to the people of Sacramento, El Dorado and Calaveras counties for subscriptions to make a survey and funds were raised for the purpose. Marlette commissioned State Senator Sherman Day, a well known engineer, to locate a route for the Emigrant Road over the Sierra to Carson Valley and Day began his task on June 11, 1855.

He completed a preliminary survey and returned to Sacramento whereupon Marlette set out with him to make a second survey. Day favored a route which today is the course of the State highway from Sacramento through Placerville to Lake Tahoe (then called Bigler Lake), thence into Carson Valley, Nevada. Later, General Marlette directed George H. Goddard, grandfather of Al Goddard of

Sacramento, to make a third investigation.

With the information gathered by his engineers, Marlette and the Wagon Road Commissioners advertised for bids for the work of building the road and a contract was awarded to L. B. Leach of Stockton. Subsequently it was found that Leach was a fictitious person and the charge was made that enemies of the proposed road had connived to submit an exceptionally low bid in order to delay construction.

DECLARED UNCONSTITUTIONAL

Meanwhile, the State Controller refused to audit accounts under the Wagon Road Act and Marlette and those who had contributed money for the surveys were out of pocket. Their claims remained unpaid until April 30, 1857. The Controller later was sustained, the Supreme Court in December, 1856, declaring the Wagon Road Act unconstitutional.

With the legality of the statute questioned, the citizens of Placerville in June, 1856, voted $5,500 for a road from there to Carson Valley over the Day-Marlette route. In February, 1857, President Pierce approved a congressional appropriation of $300,000 for a wagon road from Fort Kearney, via South Pass of the Rocky Mountains and Great Salt Lake Valley to the eastern boundary of California, near Honey Lake.

Immediately, Californians set to work to raise funds for a road over the Sierra to meet the projected Federal road at Honey Lake. On May 11, 1857, representatives of Sacramento, El Dorado and Yolo counties met in Sacramento. Twenty thousand dollars were subscribed by Sacramento, an equal amount by El Dorado and ten thousand dollars by Yolo. The Day route was approved.

Finally, in November, 1858, the road linking Sacramento and Placerville with Carson Valley was completed.

Lack of legislative support for the Emigrant Road and opposition by interests involved in building the first transcontinental railroad resulted in the road being taken over by private capital following the discovery of great silver deposits in Nevada and the excessive traffic from Sacramento over the Sierra to the Comstock and other Nevada mines. The route became a toll road and paid huge dividends to its operators.

Years later, in 1895, when the legislature created the State Bureau of Highways, the old pioneer toll road, known as the Lake Tahoe Wagon Road, was taken over by the State, thus becoming the starting point of the vast California highway system of today.



Old woodcut picture of the Emigrant Wagon Toll Road in 1865 from Albert D. Richardson's book "Beyond the Mississippi," published in 1867, illustrating his description of a trip in a six horse coach from Lake Tahoe to Placerville.

IMPROVED TYPE OF SOIL SAMPLER
for Exploration and Sampling Operations

By THOMAS E. STANTON, Jr.
Materials and Research Engineer, Division of Highways

THE soil sampler described herein was developed over a period of six years, starting in 1930, by engineers of the Materials and Research Department of the California Division of Highways. It was designed to avoid the delay and expense incidental to driving and cleaning out a well casing before taking samples, and has been successfully used in its present form for obtaining undisturbed soil samples to depths of over 250 feet under a wide range of conditions.

Two hundred thirty-two holes aggregating over 13,000 lineal feet of cores have been cut with the 2-inch sampler since 1933 in connection with foundation investigations for the San Francisco-Oakland Bay Bridge and other highway, bridge, and grade separation projects.

The equipment was developed not only to reduce the cost of deep sampling, but also to obtain samples in an undisturbed state so as to accurately determine foundation conditions, including moisture content, density, and consolidation. In clay and cemented material samples have been taken to depths of approximately 150 feet below the bottom of a cased or open hole, thereby greatly reducing the total drilling expense. Practically continuous 2-inch diameter core samples have frequently been taken to depths of 100 to 200 feet at a total cost of less than $1 per foot, including rental of equipment and all operating expenses.

CONVENTIONAL SAMPLERS SLOW

All grades of foundation material have been sampled, the equipment being suitable for use in formations of hardness ranging up to "soft" rock. The sampler unit has been driven as much as two or three feet into bedrock where the material consisted of partially disintegrated sandstone or shale.

Soil samplers used on the preliminary investigation of the San Francisco-Oakland Bay Bridge foundation material[1] required casing to just above the elevation at which a sample was desired. After cleaning the casing, samples were obtained to a depth of 18 inches below the bottom of the cased hole. The casing was then driven to the next depth to be sampled, the hole again cleaned, and samples taken as before. Great care and slow methods were required in driving and cleaning the casing so as not to disturb the material immediately below the bottom of the hole.

Conventional equipment[2] usually included a vent hole with either a flap or ball valve action at the top of the sampler section. Sand and silt particles frequently lodged in the valve preventing a satisfactory seal against suction, thus resulting in the loss of the sample.

CASING COST SAVED

Prior to and during the period the original borings for the Bay Bridge were under way, the Materials and Research Department was working on the development of a sampler designed to eliminate unsatisfactory and expensive operation features of the conventional type of equipment. The new sampling device developed as a result of these studies is a decided improvement over the old type.

A clean open hole is not required and the use of casing is not essential for holes up to 100 feet unless free flowing sand or gravel is encountered. Casing is required only when skin friction becomes too great to permit ready driving and pulling of the sampler.

On the foundation study recently completed for the proposed San Francisco Interurban Bay Bridge Terminal and Viaduct construction, 70 to 90 feet of casing was used to seal off an overlying strata of free flowing eolian and marine sands. Boring and sampling operations were then satisfactorily continued through marine clay and clayey sand to bedrock at depths up to 220 feet without further casing, at a saving of one-third to one-half the cost under previous methods.

DESCRIPTION OF SAMPLER

The sampler unit, shown in illustrations on adjoining page, consists of a cutting point, sampler sections, couplings, 2-inch brass tube sample retainers, and a plug, screw, and nut assembly. The cutting point is constructed of tool steel and its outer shape conforms in general with that found by Veihmeyer and Beckett[3] to be suitable for securing undisturbed samples of agricultural soils.

The sampler sections, couplings, and the cutting point are bored on the inside to receive the brass tube sample retainers. These brass tube retainers permit ready removal of the cores from the sampler and prevent disturbance of the specimens. This part of the outfit is conventional.

The important element of the new sampler is the plug assembly. First, it plugs the sampler until the depth is reached at which samples are desired; and second, it provides a seal against suction immediately above the top of the sample.

THREAD STRESS PREVENTED

The screw shaft and nut section are provided with a fast pitch, left hand thread, the former being connected to the plug in a manner to permit swivel action.

Extension rods and all sampler sections are provided with suitable size R. H. square threads. In the couplings the ends are butted against a square shoulder in order to prevent excessive thread stress during driving.

Samples are taken by (1) driving the sampler as a plugged tube to the desired depth; (2) retracting the plug and forcing the open sampler into undisturbed material; (3) retracting the plug further to effect an air tight seal above the sample; (4) withdrawing the entire sampler unit to the surface.

DRILLING OPERATIONS EXPEDITED

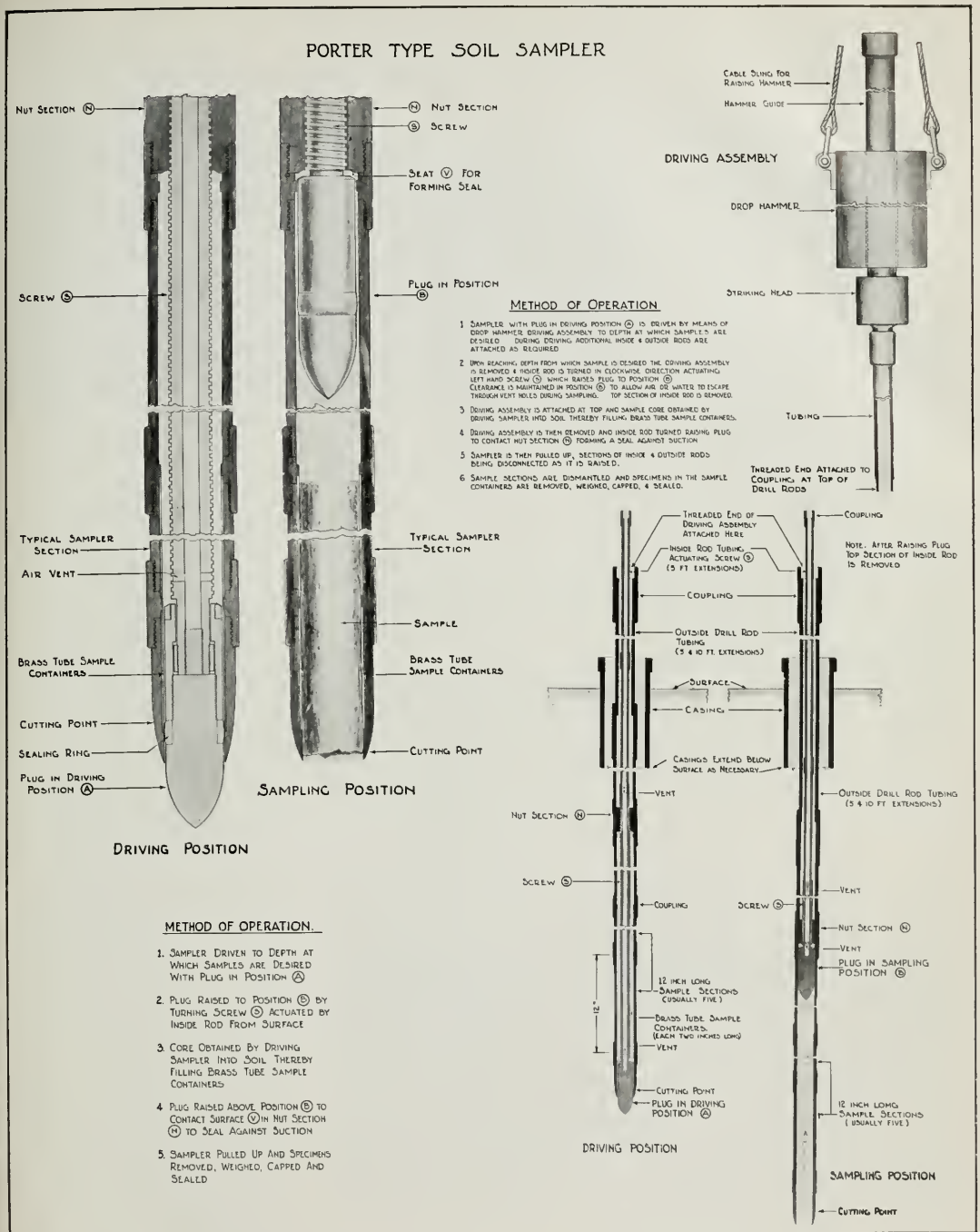
A 3 to 4 foot length of soil core is normally obtained in one sampling operation. On important work one three to four foot sample is usually taken for each five feet of depth. In many cases, however, the driving record for the plugged sampler furnishes sufficient information regarding the uniformity of the material. In such cases the drilling operations are expedited by taking samples at less frequent intervals.

Two samplers complete with plug, screw, and nut assembly are usually kept on rush jobs so that drill operations will not be shut down while samples are being removed and prepared for shipment to the laboratory.

The string of 2-inch long brass tube

[1] (E.N.R., June 23, 1932, P. 891.)
[2] (A.S.C.E., Proceedings, May, 1933, P. 804.)
[3] (Soil Science, Vol. 25, 1928, P. 147, and Vol. 27, 1929, P. 381.)

(Continued on page 20)


PORTER TYPE SOIL SAMPLER
NUT SECTION (N)
SCREW (S)
TYPICAL SAMPLER SECTION
AIR VENT
BRASS TUBE SAMPLE CONTAINERS
CUTTING POINT
SEALING RING
PLUG IN DRIVING POSITION (A)
DRIVING POSITION
(N) NUT SECTION
(S) SCREW
SEAT (V) FOR FORMING SEAL
PLUG IN POSITION (B)
TYPICAL SAMPLER SECTION
SAMPLE
BRASS TUBE SAMPLE CONTAINERS
CUTTING POINT
SAMPLING POSITION
METHOD OF OPERATION
1 SAMPLER WITH PLUG IN DRIVING POSITION (A) IS DRIVEN BY MEANS OF DROP HAMMER DRIVING ASSEMBLY TO DEPTH AT WHICH SAMPLES ARE DESIRED. DURING DRIVING ADDITIONAL INSIDE & OUTSIDE RODS ARE ATTACHED AS REQUIRED
2 UPON REACHING DEPTH FROM WHICH SAMPLE IS DESIRED THE DRIVING ASSEMBLY IS REMOVED & INSIDE ROD IS TURNED IN CLOCKWISE DIRECTION ACTUATING LEFT HAND SCREW (S) WHICH RAISES PLUG TO POSITION (B) CLEARANCE IS MAINTAINED IN POSITION (B) TO ALLOW AIR OR WATER TO ESCAPE THROUGH VENT HOLES DURING SAMPLING. TOP SECTION OF INSIDE ROD IS REMOVED.
3 DRIVING ASSEMBLY IS ATTACHED AT TOP AND SAMPLER CORE OBTAINED BY DRIVING SAMPLER INTO SOIL THEREBY FILLING BRASS TUBE SAMPLE CONTAINERS.
4 DRIVING ASSEMBLY IS THEN REMOVED AND INSIDE ROD TURNED RAISING PLUG TO CONTACT NUT SECTION (N) FORMING A SEAL AGAINST SUCTION
5 SAMPLER IS THEN PULLED UP, SECTIONS OF INSIDE & OUTSIDE RODS BEING DISCONNECTED AS IT IS RAISED.
6 SAMPLE SECTIONS ARE DISMANTLED AND SPECIMENS IN THE SAMPLE CONTAINERS ARE REMOVED, WEIGHED, CAPPED, & SEALED.
CABLE SLING FOR RAISING HAMMER
HAMMER GUIDE
DRIVING ASSEMBLY
DROP HAMMER
STRIKING HEAD
TUBING
THREADED END ATTACHED TO COUPLING AT TOP OF DRILL RODS
METHOD OF OPERATION.
1. SAMPLER DRIVEN TO DEPTH AT WHICH SAMPLES ARE DESIRED WITH PLUG IN POSITION (A)
2. PLUG RAISED TO POSITION (B) BY TURNING SCREW (S) ACTUATED BY INSIDE ROD FROM SURFACE
3. CORE OBTAINED BY DRIVING SAMPLER INTO SOIL THEREBY FILLING BRASS TUBE SAMPLE CONTAINERS
4. PLUG RAISED ABOVE POSITION (B) TO CONTACT SURFACE (V) IN NUT SECTION (N) TO SEAL AGAINST SUCTION
5. SAMPLER PULLED UP AND SPECIMENS REMOVED, WEIGHED, CAPPED AND SEALED
THREADED END OF DRIVING ASSEMBLY ATTACHED HERE
INSIDE ROD TUBING ACTUATING SCREW (S) (5 FT EXTENSIONS)
COUPLING
OUTSIDE DRILL ROD TUBING (5 & 10 FT. EXTENSIONS)
SURFACE
CASING
CASINGS EXTEND BELOW SURFACE AS NECESSARY
VENT
NUT SECTION (N)
SCREW (S)
COUPLING
12 INCH LONG SAMPLE SECTIONS (USUALLY FIVE)
BRASS TUBE SAMPLE CONTAINERS. (EACH TWO INCHES LONG)
VENT
CUTTING POINT
PLUG IN DRIVING POSITION (A)
DRIVING POSITION
COUPLING
NOTE. AFTER RAISING PLUG TOP SECTION OF INSIDE ROD IS REMOVED
OUTSIDE DRILL ROD TUBING (5 & 10 FT EXTENSIONS)
VENT
SCREW (S)
NUT SECTION (N)
VENT
PLUG IN SAMPLING POSITION (B)
12 INCH LONG SAMPLE SECTIONS (USUALLY FIVE)
SAMPLING POSITION
CUTTING POINT

Colton Bottleneck Subway Replaced By Grade Separation on New Alignment

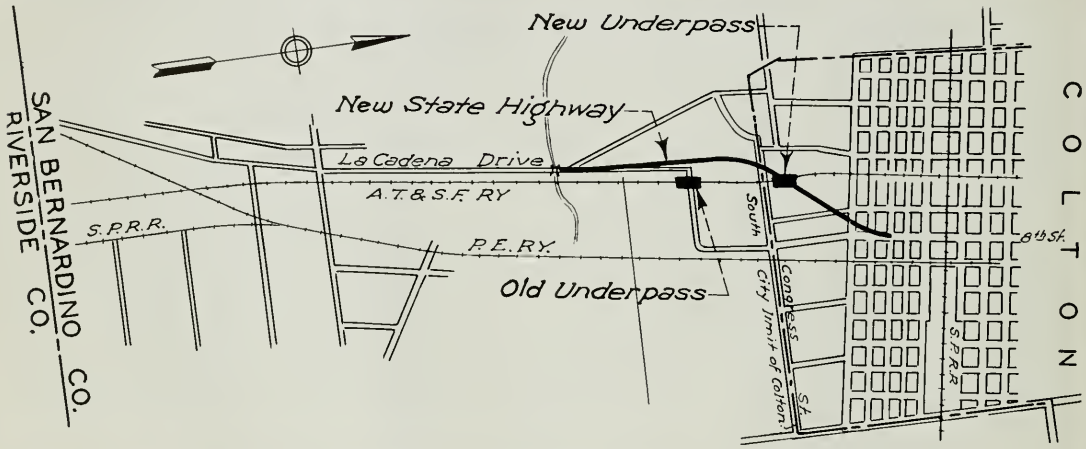
By M. A. Koontz, Asst. Bridge Designing Engineer

TO THE city of Colton in the county of San Bernardino materializes a combined Federal Aid and State Highway grade separation project: the completion of the Colton Subway on State Highway Route 43 carrying public highway traffic between San Bernardino and Riverside under the tracks of the Atchison, Topeka and Santa Fe Railway at Colton.

The new grade separation structure replaces an obsolete subway constructed in 1907 which was a hazard to the fast moving highway traffic of today. Early highway alignment standards did not consider the severe reverse curve which characterized the old subway, dangerous to contemporary traffic.



Colton grade separation improvement provides adequate highway width and a pedestrian walk.





Old subway built on reverse curve alignment and too narrow for two trucks to pass.

With the advent of greater speeds, larger commercial carriers and a vast increase in the number of vehicles on the public highway, it became apparent that the old subway and low-standard contiguous highway alignment must be replaced.

TRAFFIC BACKUP

As early as 1924 engineering studies were made to determine an economic solution of the problem which far-sighted highway engineers anticipated would arise within the next two decades. These studies indicated that a new subway on revised alignment would provide an adequate solution of

(Continued on page 25)

Budget Revision Found Necessary

(Continued from page 1)

of $11,008,602. This amount, however, does not represent an unexpended balance of funds over which the Division of Highways has complete control.

Included in the State Highway budget was an amount of $5,796,875 set aside as the 1/4-cent allocation to cities for use on city streets other than State Highway routes. The expenditure of these funds is handled by the cities themselves, and on June 1 expenditures from these budgeted funds amounted to only $1,489,976, leaving $4,306,899 as a balance to be expended for the improvement of city streets during the remainder of the biennium.

ADEQUATE BALANCE NECESSARY

As far as State Highway funds are concerned, this latter amount may properly be deducted from the cash in the hands of the State Treasurer leaving a balance of $6,701,703 on June 1 for the work of the Division of Highways.

This cash balance, however, is only a small percentage of the value of outstanding obligations of the Division of Highways. Funds are being expended daily on these obligations which include contracts in progress, work on surveys and plans, maintenance, right of way, etc. On June 1, the total unexpended balance of outstanding work orders amounted to $21,302,320. With State Highway operations reaching this volume, the cash margin of $6,701,703 is no more than adequate.

One of the important phases of efficient administration of the State Highway activities involves preparation of accurate estimates of the cost of proposed work.

SMALL SAVINGS ON CONTRACTS

On State Highway contracts awarded in the last six months, during which period the Division of Highways has had an unusually large volume of work under way, the difference between the engineers' preliminary estimates and the bids of contractors has been only eight-tenths of one per cent.

The following tabulation gives a comparison of the preliminary estimates with the contractors' proposals on all major projects for which bids were opened between November 27, 1935, and June 18, 1936:

	No. of projects	Total of estimates
North	77	$10,054,309.73
South	73	7,943,458.61
Total	150	$17,997,768.34

Total of bids	Saving	Per cent of saving
$9,995,449.93	$58,859.80	0.6
7,856,219.06	87,239.55	1.1
$17,851,668.99	$146,099.35	0.8

The above tabulations, representing contract items only, give a direct comparison of the engineers' preliminary estimates with the bids of contractors; however, the amount of $17,851,668.99 does not represent the final total cost of the work to the State as the cost of contingencies, extra work and participation items in railroad grade separation contracts, are not included in the figures given. These additional items, not included in the contracts, will bring the total cost of the 150 projects to $20,710,225.13.

ALL FUNDS ALLOCATED

The savings thus accruing on contracts have been transferred to the reserves and reallocated by vote of the California Highway Commission to additional projects.

In fact all available funds for the current biennium have been so allocated to various construction projects, and if the present rate of getting work under way continues it may be necessary to transfer to the next biennium approximately $2,000,000 in stage construction in order to complete improvements begun during the present biennium.

QUEER STORM EFFECT

During a recent severe wind storm in Orange county at a certain location on the highway Ora-2-B near El Toro automobiles were crashing into each other and stalling due to static electricity and sand. Visibility was exceedingly poor. Superintendent Glenn H. Cheeseman reports that Foreman A. C. Humphrey learned of the situation at 2 o'clock in the morning, promptly proceeded to the scene of trouble and devoted the remainder of the night to the task of detouring traffic over another road. That was beyond the call of ordinary duty.

Downtown parking abolished in Rome: 50 B. C.

Court Disallows $60,000 Claim

ANCIENT history was reviewed recently in the courtroom of Judge Peter J. Shields of the superior court, Sacramento County in an action involving contractors' claims on the Shasta Canyon project in Siskiyou County. The project extended from Yreka to the confluence of the Shasta and Klamath rivers, and was finally completed in September, 1931.

Wren & Greenough, of Portland, Oregon, were the contractors on the job, and after completion claimed approximately $60,000 in addition to the amounts paid to them. The amount claimed represented the total of 18 different items, including excavation, outside of the plans and alleged to have been wrongfully disallowed, alleged wrongful disallowance of overhaul, and many items of claimed extra work. The court, after a trial of eight days, gave judgment in favor of the State on all causes of action.

ENGINEERS' ESTIMATES FINAL

Although the court did not write a formal opinion, throughout the case the court ruled that the contractors had to plead and prove that the engineers had acted arbitrarily or capriciously in refusing to allow the contractors' claims. This ruling was made on the basis of the provisions of the contract to the effect that the engineers' estimates are final.

The preparation of the case for the State required the complete review of all details of the entire job from records of the Department of Public Works. To C. F. Waite, who was Resident Engineer on the project and who is now District Office Engineer in District VI, fell the major portion of this burden. The success of his efforts, together with those of C. S. Pope, G. R. Winslow, H. S. Comly, Ridgway Gillis, Paul F. Green, Howard Caton, A. A. Bigelow and others was demonstrated by the outcome of the suit.

Counsel appearing for the State were C. R. Montgomery and Robert E. Reed of the Legal Department of the Division of Highways.

Yes, every year is Leap Year for pedestrians.

"What makes you think he is conceited?"
"He makes people call him Colonel because he has military brushes."—*Ranger.*

MAJOR PROJECT HIGHWAY CONSTRUCTION PR

PRIMARY NORTH

As of J

County	Route	Location	Nature of improvement	Approximate mileage	Budgeted amount
Mendocino	1	Outlet Creek to Reeves Creek	Grading and surfacing	4.5	$196,000
Mendocino	1	Eleven Oaks to Willits	Grading, surfacing and bridge	0.8	60,000
Del Norte	71	Winton Corner to 0.7 mile south of State line	Grading and surfacing	5.1	140,000
Humboldt	1	Salmon Creek to Bucksport	Grading and surfacing	7.3	165,000
Humboldt	1	Trinidad to McNiels Ranch	Grading and surfacing	2.1	125,000
Lassen	29	Westwood to Copperville	Surfacing	6.6	110,000
Shasta	3	Sulphur Creek to Boulder Creek Hill	Grading and surfacing	1.5	132,000
Shasta	20	Near Shasta to near Redding	Grading and surfacing	5.0	220,000
Tehama	29	Route 3 to 1½ miles east of Dales	Surfacing	13.8	175,000
Butte	3	Biggs Road to Chico	Grading and surfacing	19.0	101,000
Yolo	6	M St. Subway to M St. Bridge	Paving shoulders	0.4	9,000
Glenn	7	Orland to Northerly Boundary	Grading, paving and bridge	2.0	80,000
Glenn	7	Willows to Orland (portions)	Grading and surfacing	10.0	250,000
Placer	17	Roseville to Loomis	Grading and paving	5.5	165,000
Nevada	37	Fox Farm to Summit Station	Grading and paving	3.8	145,000
Nevada	37	Sta. 123 to junction with Route 38	Surfacing	2.4	50,000
Nevada	37	Donner Grade to Sta. 123+00	Grading and surfacing	2.3	110,000
Nevada and Sierra	38	Floriston to State Line	Grading and surfacing	5.0	50,000
Yuba and Sierra	25	Nevada City to Downieville	Grading and surfacing		49,190
Solano	7	¾ mile north to ¾ mile south of Vacaville	Grading and paving	2.0	135,000
Fresno	4	Biola Junction to Herndon	Grading and paving	3.4	230,000
Santa Clara	68	Santa Clara-Alviso Road to San Jose	Grading, paving, bridge	3.7	425,000
Santa Clara	2	San Jose to Coyote	Grading and surfacing	10.0	200,440
San Mateo	2	Beresford to Redwood City	Grading and paving	4.5	390,000
			Total		$3,712,630

SECONDARY NORTH

Lake	15	Upper Lake to Rasmussen's Ranch and Middle Creek	Grading, surfacing and bridge	1.2	$71,000
Lassen	73	5.3 miles east of Litchfield to Secret Valley	Grading and surfacing	13.7	103,500
Yolo	87	Woodland to Knight's Landing	Surfacing	10.8	17,000
El Dorado	38	Lower crossing Truckee River and approaches	Bridges and grading approaches		40,000
Solano	74	In Benicia	Grading and surfacing		10,000
Merced	32	Los Banos to easterly boundary (portions)	Grading, shoulders and resurfacing		210,000
San Mateo	56	Farralone City to Rockaway Beach	Grading	5.9	425,000
San Mateo	107	Menlo County Club to Woodside	Grading and surfacing		25,000
Santa Clara	Feeder Road	4th Street extension in San Jose	Grading and surfacing	1.2	81,000
			Total		$982,500

PRIMARY SOUTH

Santa Barbara	2	Rincon to Carpenteria and Carpenteria Creek	Grading and paving and bridge	1.6	$125,000
Santa Barbara	2	Sheffield Drive to Olive Mill Road	Grading and paving	1.6	110,000
San Luis Obispo	2	Cuesta Grade	Grading and paving and structures	3.5	665,000
Kern	4	Bakersfield to Arvin Road	Grading and paving	8.0	260,000
Los Angeles	2	Calabasas School to Brent's Junction	Grading and paving		161,400
Los Angeles	60	State Street; Lime Street to Stanley Avenue, Long Beach	Grading and paving	1.2	60,000
Los Angeles	2	Calabasas Northerly (portions)	Grading and paving		38,600
Los Angeles	60	N and O Streets, Wilmington Boulevard to Alameda Street, Los Angeles	Grading and paving	1.5	150,000
Los Angeles	9	Foothill Boulevard; Fenwick Street to Osborne and Tujunga Wash, Los Angeles	Grading, paving and bridge	3.0	295,000
Los Angeles	4	Marengo and Daly Streets; Cornwell Street to Main Street, Los Angeles	Grading and paving	1.1	120,000
Los Angeles	9	Azusa to San Bernardino County line	Grading and paving	12.0	220,000
Orange	60	Newport Beach to Laguna Beach	Grading and paving	10.0	165,000
Ventura	2	Across Conejo Creek	Bridge		14,375
Ventura	60	Across Big Sycamore Creek	Bridge		45,000
Ventura	60	Big Sycamore Creek line change and bridge approaches	Grading and paving	1.0	105,000
San Bernardino	58	Java grade separation approaches	Grading, surfacing and bridge	2.8	60,000
San Bernardino	58	Ludlow to 20 miles east Amboy	Grading, drainage and bridges		20,000
San Bernardino	31	Verdemont grade separation approaches	Grading and paving		20,000
San Bernardino	31	Mt. Pass to Nevada state line	Grading and surfacing	15.3	415,000
Mono	23	Conway Summit to 1 mile north Bodie Road	Grading and surfacing	4.0	182,615

GRAM FOR REMAINDER OF 87th-88th BIENNIUM

, 1936

PRIMARY SOUTH

County	Route	Location	Nature of improvement	Approximate mileage	Budgeted amount
Inyo	23	Four miles south of Fish Springs to Tinemaha Pass	Grading and surfacing	2.5	$34,000
San Diego	2	Approaches to Santa Margarita Creek Bridge	Grading and surfacing	0.7	48,900
San Diego	2	Del Mar to Encinitas	Grading and paving	6.3	245,000
San Diego	12	El Cajon Avenue	Paving	2.7	275,000
San Diego	2	Las Flores Underpass to San Mateo Creek	Grading, paving and structures	10.5	480,000
San Diego	2	Oceanside to Las Flores	Grading and paving	7.8	440,000
			Total		$4,754,890

SECONDARY SOUTH

Kern	140	Bridges and dips east of Taft	Structures		$36,000
Kern	141	Three bridges—Oak Street Road	Bridges		20,000
Kern	138	Maricopa to Taft	Grading and surfacing	6.0	250,000
Tulare	129–134	Strathmore to Lindsay	Grading and paving	6.8	190,000
Tulare	129	Cottonwood Creek	Bridge and approaches		25,000
Los Angeles	168	Longden Avenue to Fairview Avenue	Grading and paving	1.0	70,000
Los Angeles	168	Firestone Boulevard to Telegraph Road	Grading and paving	1.8	96,500
Los Angeles	Feeder	Palos Verdes Drive to Western Avenue	Grading and surfacing	2.0	200,000
Los Angeles	Feeder	Washington Boulevard-Spence Street to Downey Road	Grading and surfacing		100,000
Los Angeles	26	Monterey Park to Pomona	Widening and paving	18.7	335,000
Los Angeles	174	Manchester Boulevard through Downey	Grading and paving		62,000
Los Angeles	166	Across San Gabriel River	Bridge		70,000
Los Angeles	172	Anaheim-Spadra Road to Route 19	Grading and surfacing	0.6	30,000
Los Angeles	167	Across Los Angeles River on Atlantic Boulevard	Bridge		186,000
Los Angeles	167	Atlantic Boulevard, Los Angeles River east of Compton, approaches	Grading and paving		85,000
Los Angeles	158	Sepulveda Boulevard, Lincoln to La Tijera	Grading and paving	1.3	70,000
Los Angeles	158	Sepulveda Boulevard-La Tijera to Centinella	Grading and paving		125,000
Los Angeles	62	Azusa to San Gabriel River	Grading and surfacing	2.0	100,000
Los Angeles	158	Sepulveda Boulevard, Centinella Boulevard to Washington Boulevard	Grading, paving and structures		210,000
Los Angeles	175	Artesia from Atlantic Boulevard to Cerritos Boulevard	Resurface shoulders and culverts	2.5	55,000
Los Angeles	77	Philadelphia Avenue to southerly boundary	Grading and surfacing	1.2	41,700
Los Angeles	61	Red Box to Mt. Islip (portions)	Grading		263,000
Los Angeles	168	Rosemead Boulevard (portions), San Gabriel to Ramona; Whittier Boulevard South and Compton Boulevard to Firestone	Oiling shoulders, grading, paving and bridge		286,500
Los Angeles-Orange	174, 178	Firestone Boulevard and Manchester Avenue, Norwalk to Miraflores and Lincoln Avenue from S. P. R. R. to west city limits	Grading, paving, drainage	11.9	242,000
Orange	183	Across Santa Ana River on Bolsa Avenue	Bridge and approaches		50,000
Orange	179	Across Santa Ana River	Bridge and approaches		48,000
Orange	176	Carolina Avenue to Yorba Linda	Grading and surfacing	3.5	130,000
Orange	175	Southeast of Placentia	Grading and paving	1.0	56,000
Orange	178	Jog at Placentia Avenue (Route 180)	Grading and surfacing		20,000
Orange	43	Jog at 17th Street and Tustin Avenue	Grading and surfacing		20,000
Ventura	138	Across San Antonio Creek	Bridge		39,000
Ventura	79	Across Todd Barranca	Bridge		18,000
Ventura	79	Across Hopper Canon Barranca	Bridge		26,000
Ventura	79	Teague-McKevitt grade crossing S. P. R. R.	Grading		10,000
Ventura	138	San Antonio Creek and Ferguson grade, line changes	Grading and surfacing	1.2	106,000
Ventura	79	Sespe Ranch to Fillmore (portions)	Grading and pavement		118,600
Ventura	153	Camarillo to Oxnard (portions)	Grading and paving		100,000
Riverside	19	Beaumont to Bad Lands	Grading and surfacing	2.3	95,000
Riverside	19	Across San Timoteo Creek	Structure		10,000
Riverside	78	Temecula Creek at M. P. 72.3	Bridge		27,000
Riverside	77	Santa Ana River and Chino Creek	Bridges and approaches		40,000
Riverside	187	Route 26 to Palm Springs and across Snow Creek	Grading, surfacing and bridge	1.5	200,000
Riverside	43	West Boundary to Prado	Grading and paving	3.9	205,000
San Bernardino	77	Chino Drainage Canal	Bridge and approaches		38,000
San Bernadino	190	Across Indian Creek	Bridge		10,000
Mono	96	Bridgeport to 3 miles east Walker Dam	Grading and surfacing		38,250
Inyo	127	6 miles west Darwin to Panamint Sink	Grading and surfacing	18.0	70,000
San Diego	77	Lake Hodges to Escondido	Grading and surfacing	3.1	94,000
San Diego	195	Cuca Grade	Grading	3.0	38,000
Imperial	187	Brawley to Calipatria (portions)	Grading and bridges		75,000
Imperial	187	Holtville to Brawley (portions)	Surfacing		104,000
Imperial	202	Midway Wells to Calexico (portions)	Grading, surfacing, and bridges		75,850
			Total		$5,010,400

WM. T. HART APPOINTED HIGHWAY COMMISSIONER

IN RECOGNITION of his services as a member of the State Park Commission and as a tribute to the rapid progress of San Diego County, William T. Hart of Carlsbad has been appointed to the California State Highway Commission by Governor Frank F. Merriam.

Mr. Hart has resigned as a Park Commissioner to accept his new post. His appointment gives to San Diego its first representation on the California Highway Commission.

In expressing his appreciation of the honor bestowed upon him, Mr. Hart said:

"Allocation of a Highway Commissioner to San Diego County after its long fight for membership on this board is another outstanding example of Governor Merriam's understanding of the needs and development of our county."



WM. T. HART

ACTIVE CIVIC LEADER

For thirteen years Mr. Hart has been prominently identified with development projects in the southern county and during the three years he served on the Park Commission was largely instrumental in bringing into the State Park System such beauty spots as Cuyamaca, Silver Strand, Palomar, Mission Beach, Carlsbad Beach and Borego Valley.

The new commissioner succeeds the late Charles D. Hamilton of Banning and his appointment completes the Highway Commission to its full quota of five members.

Mr. Hart is president of the Hart & McClellan South Coast Land Company, of Carlsbad and a director of the Union Title & Insurance Co. of San Diego.

Born in Prairie du Chien, Wisconsin, 63 years ago, Mr. Hart recalls the pioneer dairy business of his father, who furnished milk and cream to the boats on the Mississippi River, a big industry in those days. His family removed to New York when he was a boy and he received his education in the public schools of that State. He began his business career with the New York Central Lines in the operating department, later becoming traveling agent.

After some years with the New York Central, Mr. Hart resigned to accept a position with a bond and guarantee company as general inspector, traveling from the Atlantic to the Pacific Coast. In 1918 he came to California and developed a fruit ranch in Tulare County and in 1922 settled in Carlsbad to become associated with the South Coast Land Co. He has been active in development work with that organization since that time.

Mr. Hart is a past president of the San Diego County Development Federation, a director of the San Diego Chamber of Commerce, a member of the California State Chamber of Commerce Highway Committee and a member of the Economic Council of Southern California.

During the period of his residence in California, Mr. Hart has been greatly interested in highway matters and his activities in development work

(Continued on page 28)

Paving Bay Bridge Marks Last Laps in Construction Work

WHEN, shortly after daybreak one bright morning last month, the first "buggy" full of cement for the suspension spans of the San Francisco-Oakland Bay Bridge was poured, it marked one of the final important laps as the great structure swings rapidly toward completion for automobile traffic about November 12, under the direction of Chief Engineer C. H. Purcell.

All steel work and all paving has been finished on the East Bay crossing of the bridge, and only the final coats of paint and odds and ends of the clean-up job remain to be accomplished on that section.

Final steel is also being erected for the West Bay crossing. Erection of the "shroud" at the giant center anchorage is among this last steel. The "shroud" will cover the eyebars and A-frame to which the cables are attached, and will complete the graceful design of the concrete monolith. The steel of the "shroud" acts also as a form for the concrete which will be poured to encase the eyebars and A-frame.

SHROUD FOR ANCHORAGE

Comprised of 1080 individual shipping pieces, the "shroud" is 170 feet long and approximately 50 feet high. In its entirety it will weigh 460 tons.

Meanwhile, work of closing the upper deck at the Yerba Buena Island anchorage is approaching completion. All paving in the tunnel has been finished, including the paving of the lower deck truck roadway.

The Administration Building on the Oakland fill has been entirely completed except for the installation of the inside trim.

In Emeryville, the side walls for the east half of the San Pablo undercrossing are fifty per cent completed.

On the San Francisco side, work on the construction of spans on each side of the Harrison Street crossing and on the south side of the Folsom Street crossing for the "off" ramp has been carried rapidly forward, while work has continued on the viaduct between Sterling Street and the San Francisco anchorage.

Many a driver who would not give an inch got six feet.



View of West Bay Crossing of San Francisco-Oakland Bay Bridge looking toward San Francisco showing paving laid on center lane.



Col. Willard Chevalier, President of the American Road Builders Association, thumbs first ride over East Bay Crossing from Chief Engineer C. H. Purcell.

IMPROVED SOIL SAMPLER FOR EXPLORATION

(Continued from page 12)

retainers, with contained sample, are pushed out of the sampler sections immediately following removal from the hole, cut into sections at the joints between retainers with a fine piano wire saw, capped and weighed. The weight of the 2-inch long cores, together with examination of the cut surface, immediately furnishes an index to the uniformity and character of the material. Specimens retained for shipment to the laboratory are at once taped, marked, and sealed with paraffin in order to prevent any change in the original condition.

SOIL SPECIMEN PREPARED

To determine the extent of disturbance, if any, during sampling, a large specimen of Class A-4 soil having a moisture content of approximately 17% was mixed with 10% flowers of sulphur and consolidated at the laboratory in alternate layers of light and dark material, 5% by weight of precipitated magnetic oxide being used for coloring. Cores were cut with the sampler with the results shown in the accompanying illustration. The specimens were hardened by heating at a low temperature and then cut so as to expose any deformation of the strata.

As will be noted, there was no apparent disturbance of the material in the core, whereas there is a very marked disturbance in the portion of the original sample outside of the core and adjacent to the sampling tube. The unit weight and moisture content of the 2 x 2 inch cored specimens checked within one-half of one per cent of the unit weight and moisture of the larger prepared specimen from which the core was cut.

Class A-4 soil was selected because it was the most plastic soil available which could be used without excessive shrinkage and cracking under the heating required to harden before cutting to expose the condition of the soil strata.

SIZE OF SAMPLER

Two sizes of the type of sampler described herein are now being used by the Materials and Research Department. One size, of light weight design for hand power and air hammer operation, cuts cores of approximately 1 inch diameter and is used extensively for preliminary borings ranging up to 50 feet in depth.

The sampler successfully used on deep borings for the last three years cuts a 2-inch diameter core. The design is suitable, however, for larger diameter samples if desired. The 2 inch samples are satisfactory for testing and this size sampler is operated with power equipment at a somewhat lower cost than heavier equipment.



Two-inch sampler core cut from prepared block containing 17 per cent moisture shows no disturbance of soil on periphery of core but a marked disturbance outside of the sampler.

When the site of drilling operations is accessible to truck equipment, a churn drill is usually used, with the spudder or walking beam actuating the drop hammer. Any other standard type of power drilling equipment may be used. Borings over the bay and overflow marsh land were made from a barge equipped with a derrick, winch, and jetting facilities. In deep borings the pulling capacity from the barge was sometimes insufficient and jetting was necessary to reduce the skin friction and free the sampler.

JET FREES SAMPLER

Little difficulty has been encountered in freeing the sampler unit with a jet, consisting of lengths of the inside drill rod tubing, washed down along the outside of the sampler unit without a guide. The ground disturbed in driving the sampler is more easily jetted than the undisturbed material away from the hole, and therefore the jet usually follows down directly adjacent to the sampler. In some cases a ring is slipped over the top of the sampler unit and attached near the bottom of the jet to serve as a guide.

The 1-inch hand operated sampler designed in 1930 was perfected and used until 1933 for obtaining samples in penetrable ground to depths of 60 feet. The 2-inch size sampler was built and put into use during the first half of 1933, since which time approximately 13,000 lineal feet of 2-inch borings have been made on major projects. In addition, several thousand feet of hand borings 30 to 50 feet in depth have been made.

On the San Francisco Bay Bridge Terminal Foundation investigation, twenty-one holes were bored from 50 to 220 feet in depth. During the first part of the work the outfit was not equipped with casing or jetting equipment. An effort was made to drive through the sand strata without casing and jetting, with resultant time loss and increased cost. As soon as the first procedure was abandoned, however, and casing and jetting through an average of 80 feet of sand strata resorted to, the boring operations speeded up and the cost correspondingly fell off.

The sampler described herein was originally devised by O. J. Porter, Associate Physical Testing Engineer, in charge of aggregate and soil tests and investigational work. J. L. Beatty, Junior Testing Engineer, suggested valuable improvements and George Pomeroy, Chief Machinist of the Department, assisted Porter and Beatty in mechanically perfecting the design.



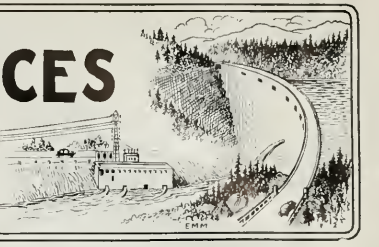
DIVISION OF WATER RESOURCES

OFFICIAL REPORT

AS OF

June 1, 1936

EDWARD HYATT, State Engineer



The organization of several new districts in the San Joaquin Valley, which plan to take water from the Central Valley Project, has been stimulated by recent congressional approval of an appropriation of $6,900,000 for carrying the project forward during the coming year.

Petition for the formation of Orange Cove Irrigation District was presented to the board of supervisors of Fresno County and the board set June 23d as the date for further hearing on the plan.

Other new districts recently formed to purchase water from the Central Valley Project include the North Kern Water Storage District embracing an area of over 50,000 acres in Kern County and the Contra Costa County Water District which was formed at an election held May 5, 1936. Other news of various activities of the Division of Water Resources is contained in the monthly report of the State Engineer, as follows:

DISTRICT SECURITIES COMMISSION

Among the matters which came before the Commission at the regular meeting in San Francisco June 12, 1936, the following petitions were given consideration:

Upon the application of Santa Clara Valley Water Conservation District, a bond issue in the amount of $400,000, authorized at an election held May 12, 1936, was certified as legal investment for savings banks and other specified purposes.

A refunding bond issue of South San Joaquin Irrigation District in the principal amount of $3,978,000 was validated for certification by the State Controller.

The first refunding issue of bonds of Lindsay-Strathmore Irrigation District in the amount of $859,000 was approved for certification.

Petition of Fairoaks Irrigation District for approval of entrance into a contract, for drilling a test well in the town of Fairoaks, was granted.

SUPERVISION OF DAMS

Application for the construction of the Lake Gregory dam was filed on May 21, 1936, by the Crest Forest County Water District, Crestline, California. This is to be a compacted earthfill structure 65 feet in height and storing 1900 acre feet for recreational use. The estimated cost is $60,000. This application was approved June 18, 1936.

Application for alteration of the Lake Fordyce dam in Nevada County was filed on June 16, 1936, by the Pacific Gas and Electric Company. The work proposed includes the installation of radial gates and increasing the spillway capacity.

Application for the alteration of the Silver Lake dam in Los Angeles County was filed on June 19, 1936, by the city of Los Angeles. The work proposed includes the construction of a new outlet and tower, as well as spillway construction.

At O'Shaughnessy dam of the city of San Francisco concrete is being placed in the lower portions of the enlarged structure.

At the West Valley dam in Modoc County the fill is practically complete as well as the excavation for the spillway. Lining of the spillway will be started shortly.

No further progress has been made at the Mad River dam other than proceeding with the exploratory work.

Kent Dam No. 2 on the coast in San Mateo County has been completed.

Work is progressing satisfactorily on the Sheffield dam of the city of Santa Barbara.

Concrete is being poured in a portion of the alteration work at the Lake Hodges dam in San Diego County.

Construction of Cajalco dam of the Metropolitan Water District and the San Gabriel Number 1 dam of the Los Angeles County Flood Control District is proceeding satisfactorily. At the San Gabriel dam, tests are being run on the model spillway prior to submission of the final design.

Progress is being made on the work in connection with the construction of Grant Lake and Long Valley dams of the bureau of water works and supply of the city of Los Angeles.

Work on the Arcata dam at Arcata is proceeding slowly.

The usual spring inspections to determine repairs necessary are being made as rapidly as possible in order that opportunity may be had for the completion of necessary repairs prior to the next runoff season.

FLOOD CONTROL AND RECLAMATION

Maintenance of Sacramento Flood Control Project

The maintenance force has been engaged during this period on miscellaneous repair and improvement work, in connection with bridges, structures and culverts. The seepage ditch culverts at Pumping Plants Nos. 1 and 2 have been lengthened, preparatory to rearranging and improving the grounds at the plants.

Pumping Plants Nos. 1, 2 and 3 on the Sutter By-pass have been completed by the California Debris Commission, although they have not yet been accepted and turned over to this department. We have moved the old operator's house from Pump 1 to Pump 3.

The heavy growth of grass and weeds has necessitated fire guards around the timber structures. Some work has been done in eradicating wild lettuce and sow thistle from the levees. Repairs have been made to the launches *Mud Hen* and *Alioth* and to the mess-house barge. This barge is now in use by the War Department on cooperative work.

Relief Labor Work

Work is being continued on the clearing of the Feather River channel above Marysville in Yuba County. The number of relief laborers available has increased from 20 to 70 during this period and it is probable that this will be further increased during the summer. New applications are being prepared to cover WPA projects to operate during the coming fall, winter and spring.

Bank Protection Program

The cooperative program for bank protection work by the State and Federal Government, approved in June, 1932, will be continued. This program was discontinued in October, 1934, and its resumption has been directed by Major General Markham, Chief of Engineers. It is expected that this will bring about the expenditure of approximately $400,000 in bank protection work on the Sacramento River in 1936. The detailed program has been worked out by the District Engineer, U. S. Engineer's Office, in conjunction with this office, and has been submitted for approval. It is expected that active work will be commenced by July 15th.

Sacramento Flood Control Project

Three contracts, to be completed by December 31, 1936, have been let by the California Debris Commission, for the completion of levee construction on the right bank of the Sacramento River from Wohlfrom's to Princeton, on the left bank of the Sacramento River from Colusa to Moulton weir, and on the left bank of the Feather River in Reclamation District No. 784. With the completion of these levees the most critical situations in the flood project will be relieved.

This Division has now under way the work of moving houses, barns and other improvements from the levee right-of-way on the Boggs ranch opposite Colusa and the Watt ranch near Princeton. This will involve the moving of five buildings. Work on miscellaneous construction on the American River levee right-of-way has been continued during

(Continued on next page)

the period, chiefly in the construction of fences and installation of pipes.

WATER RIGHTS

Supervision of Appropriation of Water

During the month of May, 39 applications to appropriate water were received; 5 were denied and 11 were approved. During the same period 2 permits were revoked and rights were confirmed by the issuance of 14 licenses.

Mining was again the predominant activity among the new appropriators, as it was throughout the years 1933 and 1934. There is, however, a notable increase in appropriations for agricultural purposes and among them a considerable number for projects of some magnitude.

Field inspections preliminary to the issuance of permits were made in Sonoma, Mendocino, Humboldt, Trinity, Del Norte, Siskiyou, San Mateo, Santa Clara, San Joaquin, Calaveras and Sacramento counties.

FEDERAL COOPERATION—TOPOGRAPHIC MAPPING

Field work in connection with the cultural revision of the Hesperia, San Antonio, San Bernardino and Cucamonga sheets in San Bernardino County was completed and progress was made in connection with the office work. Progress was also made on field work in connection with the San Bernardino No. 4 Quadrangle in San Bernardino County and the Tobias Peak Quadrangle in Kern and Tulare counties. Office work was completed on the Kreyenhagen Hills Quadrangle in Fresno County and also on the Burney Quadrangle in Siskiyou County. Progress was made on the Paynes Creek Quadrangle in Tehama County.

SACRAMENTO-SAN JOAQUIN WATER SUPERVISION

During the past month the office and stenographic work in connection with the report on Sacramento-San Joaquin Water Supervision for the year 1935 was completed. This is a report showing the diversions, return flow, stream flow and acreage irrigated in the Sacramento-San Joaquin territory and the encroachment and recession of salinity in the delta. The mimeographing of the report is progressing satisfactorily and it should be completed by July 10th.

Field work is in full swing and data to make a report similar to 1935 is being gathered. Three engineers are in the field, two full time and one part time.

No marked increase in the salinity in the Delta has been observed. This is due to the storm early this month which increased the flow at Sacramento from 15,000 c.f.s. on June 6th to 33,000 on June 8th. The flow at present is about 13,000 c.f.s. and will no doubt continue to decrease.

CALIFORNIA COOPERATIVE SNOW SURVEYS

During the past month normal melting of the Sierra snow pack has continued. In the absence of any unusual protracted hot spells and periods of excessive warm rainfall, the runoff has proceeded in an orderly fashion and no floods have occurred. The bulk of the pack has now melted and snow remains only on the higher summits and in sheltered locations.

As soon as the mountain roads became passable, the snow survey equipment of the shelter houses was gathered up and collected at convenient central locations where it will remain in storage during the summer.

Work in the office was continued in bringing up to date precipitation data. Previous forecasts are being reviewed and all data gathered during past years is being analyzed with a view to more accurately evaluating the various factors affecting snow runoff. The results of such studies to date, are very gratifying although in some cases the need for an expansion of snow surveys to collect more data is evident.

WATER RESOURCES

South Coastal Basin Investigation

Good progress has been made in the field and office on the South Coastal Basin Investigation during the present month. Bulletin No. 39D, giving hydrological data of the South Coastal Basin for the year 1935 has been approved by the director for release and is ready for distribution.

San Luis Rey River Investigation—San Diego County

The investigation and survey of the San Luis Rey River in San Diego County being made under the direction of this Division in cooperation with WPA, city of Oceanside, county of San Diego, and Carlsbad Mutual Water Company has been temporarily suspended owing to lack of WPA funds. This work is for the purpose of securing data and preparing plans for flood control, the rectification of the river channel, and the conservation and utilization of the waters of the San Luis Rey River. It is expected that work will be started again this month.

CENTRAL VALLEY PROJECT

With an appropriation of $6,900,000 by congress the United States Bureau of Reclamation is exerting every effort to complete, at an early date, the preparation of plans preparatory to starting construction on the initial units of the project. While congress allocated $6,000,000 of the appropriation to the Friant Dam, Friant-Kern Canal, and contiguous units in the San Joaquin Valley, work will proceed without interruption on the Contra Costa County Conduit and Kennett Dam with funds already provided the United States Bureau of Reclamation by the Public Works Administration.

Preliminary investigations and exploration work have been carried on during the month at Kennett and Friant dam sites, and surveys continued along the Contra Costa Conduit and the Friant-Kern Canal by the United States Bureau of Reclamation. Appraisers are working in the field evaluating land and necessary rights of way for the construction of the project. Also the Division of Highways has continued drilling operations at the proposed site of the combination highway and railroad bridge across the Pit River. The State Department of Public Works and all state agencies interested are assisting the United States Bureau of Reclamation in every way possible in order to facilitate the early commencement of construction work on the initial units of the Central Valley Project.

Good Roads Earning Substantial Profits For Highway Users

HIGHWAYS pay their way by reducing the operating costs of vehicles using them, and on heavily traveled roads they return substantial profits to the public, says the U. S. Bureau of Public Roads after a study of the mileage of vehicle travel in three states in comparison with highway expenditures. Annual payments for highways, the bureau reports, amount to slightly more than one cent per mile of vehicle travel on all highways in Michigan, Wisconsin and Minnesota, according to figures collected by this bureau of the U. S. Department of Agriculture. In Michigan and Wisconsin the payment is 1.08 cents per mile and in Minnesota 1.1 cents per mile.

Analysis of highway costs and travel on the state systems, which include federal-aid roads, of Wisconsin and Michigan shows that payments amount to .83 cent and .86 cent per mile of travel respectively. The figures for county roads are 1.23 cents in Wisconsin and 1.66 cents in Michigan.

The lower costs for main highways agree with the well established rule that large volumes of traffic make possible the construction and maintenance of high-type surfaces at a very low cost per mile of travel.

The actual saving in vehicle operating cost resulting from replacing a dirt road with a smooth, hard surface has been variously estimated and is probably not less than three cents a mile.

On this basis, says the bureau, a large mileage of highways is paying tremendous profits to highway users. Actual payment of gasoline taxes and motor vehicle fees, when distributed in proportion to travel on different roads show that many highways are earning substantial profits for the public.

In connection with the steering gear of an automobile there is one thing more dangerous than a loose bolt, and that is a tight nut.—*From Better Roads.*

The 1906 output of the automotive industry in this country was 34,000 vehicles.

NEW CUESTA GRADE WILL ABOLISH 63 CURVES

(Continued from page 2)

good practice. These studies have been quite exhaustive in their scope and include three preliminary surveys, two via the westerly slope of the canyon and one along the easterly slope on which side the present road is located.

Soil investigation crews, under the direction of the Division of Highways testing and research laboratory, are now engaged in drilling, taking soundings, samples, etc., in order that every feature of the materials to be encountered may be predetermined.

TUNNEL IS OPEN CUT

The consequent shortening of the proposed lines over that of the existing crooked course makes it necessary to cross the summit of the grade in a much deeper cut than now exists, such a situation necessarily leading to a study relative to tunnel vs. open cut construction. Present indications appear to favor the open cut. The line as at present tentatively proposed would traverse the easterly slope, somewhat below the existing road.

A portion of the present road can be used as a detour. On the balance a detour road will have to be constructed to take care of traffic, a very necessary but costly feature.

Passing over the summit the proposed line follows down the easterly slope, crossing the Southern Pacific Railroad on an overhead structure near the northerly end of the project. This line utilizes a 7 per cent maximum grade.

TENTATIVE GRADING PLANS

Tentative grading section at the present provides for a 52-foot width in fills and 46-foot width plus 3-foot ditches in cuts. Such section allows for an ultimate 40-foot width of pavement surfacing.

Due to the magnitude of cuts and fills involved and the necessity of allowing time for their stabilization, the new surfacing will probably consist of either 30 feet or 40 feet of an oil treated rock surfacing. This temporary surfacing will later provide a subbase for a more permanent surfacing, such as is generally used on this main-line road.

The following are the more interesting comparisons between the present road and the tentative design of the proposed improvement and very clearly indicate the decided improvement, safer and more satisfactory traffic facility which will be provided:

Feature of construction	Present	Proposed (tentative)
Total number curves	71	8
Total number curves, 100-ft. radius or less	21	0
Total number curves, 125-ft to 250-ft. radius	24	0
Total number curves, 275-ft. to 500-ft. radius	10	0
Total number curves, 525-ft. to 1000-ft. radius	11	0
Total number over 1000-ft. radius	5	8
Total delta of curves	3633°	242°
Maximum grade	7.007%	7%
Saving in distance		0.73 mile

Truck Problem as England Sees It

In the matter of regulation of commercial motor vehicle transportation on public highways, California and England, although occupying widely separated portions of the globe, are confronted with strikingly similar problems.

At a recent meeting of truck operators in London, Mr. Hore-Belisha, Minister of Transport, after hearing demands of the commercial vehicle industry for improved roads and bridges and lower rates of taxation, quite emphatically advised the operators to be patient and not to raise raucous voices in protest.

Addressing a convention of the Commercial Motor Users Association and the Associated Road Operators, the Minister of Transport said:

"We shall proceed with vigour and determination to give you what you require. The amalgamation of your two important associations now enables your industry to speak with one voice. Is it going to be a raucous voice, bellowing in our ears, or is it going to be a sweet one? So far as the Ministry of Transport is concerned it matters not. We shall proceed with the task that lies before us according to our lights and with resolution and conviction that we are doing the right thing by your industry and the nation. You can and will, I am sure, give us your help and counsel. That, I think, is the better course and the course which has helped you in the past. We shall try to provide for, and anticipate, your demands on the roads of this country."

The Minister of Transport said that highway plans already submitted call for an expenditure on a five-year program of approximately $650,000,000 in addition to normal expenditures from the Road Fund for highway improvements amounting to $87,500,000 annually.

California's greatest tourist summer is definitely here and the tide still rising rapidly, according to the touring bureau of the Automobile Club of Southern California.

That bureau points to the unprecedented number of information inquiries received by it in May from all parts of America, higher by about 2000 than in any other month in club history, which means thirty-six years.

Very often what father would like most to get out of his new car is the rest of the family.

Highway Chiefs to Meet in S. F.

State highway engineers from all over the United States will convene in San Francisco December 7 to 10 inclusive when the American Association of State Highway Officials holds its annual meeting there.

This was the announcement made by California State Highway Engineer C. H. Purcell, chief engineer of the San Francisco-Oakland Bay Bridge, who is also a member of the executive committee of the highway officials' association.

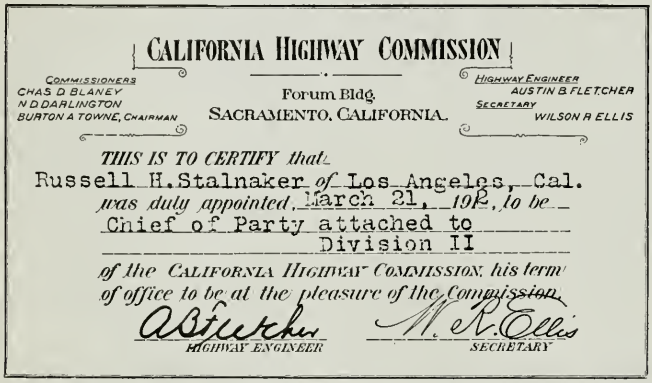
Mr. Purcell said that W. C. Markham, executive secretary of the Association, will arrive in San Francisco next month to complete arrangements for the convention.

Two major highway projects, the San Francisco-Oakland Bay Bridge (which will be open to automobile traffic at convention time) and the Golden Gate Bridge, were powerful factors that influenced the executive committee at its midyear meeting on June 22 to select San Francisco for the annual meeting.

In the Field With the Old Timers



Ten-team freight outfit hauling supplies for highway crews, Shasta County, 1914



CALIFORNIA HIGHWAY COMMISSION

COMMISSIONERS
CHAS. D. BLANEY
N. D. DARLINGTON
BURTON A. TOWNE, CHAIRMAN

Forum Bldg.
SACRAMENTO, CALIFORNIA.

HIGHWAY ENGINEER
AUSTIN B. FLETCHER
SECRETARY
WILSON A. ELLIS

THIS IS TO CERTIFY that
Russell H. Stalnaker *of* Los Angeles, Cal.
was duly appointed, March 21, 1912, *to be*
Chief of Party attached to
Division II
of the CALIFORNIA HIGHWAY COMMISSION, *his term of office to be at the pleasure of the Commission.*

A. B. Fletcher
HIGHWAY ENGINEER

W. A. Ellis
SECRETARY



Old Oregon Stage Road through Shasta County as it looked in 1912.

A NEW member of the Old Timers' Club of the Division of Highways is R. H. Stalnaker, Equipment Engineer, who is in charge of the Headquarters Shop of the Department of Public Works in Sacramento.

Mr. Stalnaker is doubly qualified for membership in the club in that he possesses two identification cards issued to employees by the first California Highway Commission. One of his prized cards certified to his appointment as Chief of Party attached to Division (now District) 11 on March 21, 1912. The second, issued one year later to the day, shows he was promoted to the post of Principal Assistant of Division 11.

"For your information," writes Mr. Stalnaker, "the title of 'Principal Assistant' in 1913 covered the position now known as 'Assistant District Engineer.'"

HAS A BIG JOB

Mr. Stalnaker was appointed Principal Highway Equipment Engineer of the Division of Highways in July, 1921. His job today is one of the most interesting and important in the service. Upon him falls the responsibility of keeping in perfect condition approximately 600 passenger cars, 1000 trucks and about 2000 pieces of equipment used by the Division of Highways in its far-flung highway building and maintenance operations.

In the Headquarters Shop the service varies from adjusting a carburetor to the construction of a huge forest fire fighting machine and repairing and rebuilding great rotary snow plows. The shop occupies a total of 125,000 square feet of space.

The Equipment Department is a self-supporting agency of the Division of Highways. It is maintained by funds paid by the other divisions and State Departments as rentals for equipment. During the last fiscal year these rentals amounted to $1,924,000 which, with miscellaneous income of $3,000, made a total of $1,927,000.

SHOWS NET PROFIT

Operating expenses amounted to approximately $1,100,000. There was set aside for depreciation and

reserve $713,950 so that the year's operations showed a nice net profit.

Mr. Stalnaker came to California in October, 1906. In making his application for membership in the Old Timers' Club he forwards his two old identification cards and writes:

"After coming to California, I worked for a few months for various firms in Los Angeles engaged in land subdivision work. I went to San Diego in June, 1907, and entered the employ of the Spreckels interests in that city as an engineer. In the spring of 1910 I went to the San Diego County Highway Commission under Austin B. Fletcher, who at that time was Secretary-Engineer of the commission and later was the first Director of the California State Department of Public Works.

ENTERED STATE SERVICE

"In August, 1911, I went to the Los Angeles County Highway Department and worked there as draftsman and resident engineer until I entered the service of the California Highway Commission.

"I reported for duty at Redding on April 1, 1912, and was in charge of a location party there until March, 1913, when I was appointed Assistant Division Engineer of that Division.

"In February, 1918, I was transferred to the Headquarters Office in Sacramento as Assistant Highway Engineer. In the spring of 1920 I was assigned to the position of General Inspector for the northern part of the State and served in that capacity until my appointment as Equipment Engineer in July, 1921. I have been in charge of the Equipment Department since that time."

During his first employment with the Division of Highways in 1912 and 1913 Mr. Stalnaker was engaged in the interesting and arduous work of locating a route for the Pacific Highway, State Route No. 3, through the rugged, mountainous country of Shasta County north of Redding.



Surveying party working on bluff near Delta, Shasta County, locating Pacific Highway through Sacramento River Canyon in 1913

The old Oregon Stage Road, a narrow, winding dirt trail worn and rutted by the wheels of the pioneers' covered wagons, was the only available route through that rough terrain when the newly organized field parties began the work of surveying and building a State highway to replace it.

It meant many months of living in crude camps in the heart of a forest wilderness, scaling precipitous cliffs or hanging from them by ropes to do the necessary surveying for a highway with grades and alignment that would be travelable by automobiles.

All food and supplies for the crews had to be freighted in from Redding by ten-team outfits and required many miles and days of heavy hauling. Mr. Stalnaker's camera caught some interesting "shots" of the parties and their work which are reproduced in this article.

Colton Bottleneck Subway Abolished

(Continued from page 14)

the problem a traffic bottleneck and danger spot for motorists.

On account of more serious grade separation problems at other locations which required available highway funds for their solution, reconstruction of the existing subway was deferred.

The heavy inter-city traffic between Riverside and San Bernardino has long been hampered by the sharp curves, lack of sight distance and restricted width at the old subway. During rush hours, traffic has often backed up as much as one-half mile on each side of the old subway.

The old subway was so narrow that accidents repeatedly occurred when too wide loads became locked inside of the structure and all traffic had to detour for several miles.

RIGHT TURNS ELIMINATED

The old subway approaches included four right angle turns. The new subway eliminates all of these right angle turns. The width of the new structure is ample for heavy vehicle traffic and an additional width is provided for pedestrians.

There will be a saving in distance of one-fifth of a mile.

This project was financed from Federal funds which must be devoted solely to railroad grade separations. The location of the new subway was made so that when other funds are available to extend the highway south toward Riverside, a direct connection can be made to the Santa Ana River Bridge.

Voice over wire: "Madame, your husband has been run over by a truck!"

Madame: "Good heavens! On the afternoon of my bridge party!"

Approximately 3,000,000 children are transported to and from school in more than 77,000 motor buses, according to statistics gathered from school officials throughout the United States.

Bank Clerk: "So you wish to open a joint account with your husband. What kind?"

Mrs. Bright: "Oh, just a deposit account for him—a checking account for me."

Plea For Cooperation in Preserving Benchmarks

Reprinted by request from ENGINEERING NEWS RECORD

SIR—This is a plea for the cooperation of engineers in preserving benchmarks, in their own interest as well as that of profession and public.

The United States Coast and Geodetic Survey during the past 65 years has been extending lines of precise levels ("first-order" levels) throughout the country. These first-order lines are spaced at intervals of about 100 miles, while within these areas the leveling is of second-order accuracy. The leveling in the vertical control net now totals slightly over 250,000 miles of lines, with benchmarks set at intervals of several miles on the oldest work, and on the latest leveling about one mile.

This work has established well over 100,000 benchmarks, most of which are marked by properly inscribed metal tablets set in concrete posts, bridge abutments, culvert headwalls and other structures such as buildings, monuments and seawalls.

Frequently new construction or repair to existing structures makes it necessary to destroy these marks, in spite of the fact that every effort has been made to place them where they will be as permanent as possible. This bureau has no funds from which to pay field parties to go about and relocate these marks when they must be moved. The result is that, if these marks are to be preserved for the use of all engineers and surveyors who may have occasion to use them, we must depend on the cooperation of engineers and others throughout the country for assistance in their preservation.

We have worked out a routine method of handling such cases. If engineers who encounter our marks in the course of construction, repair or maintenance operations will cooperate as outlined below, the destruction of useful benchmarks will be very much reduced.

As soon as it becomes known that a mark must be moved, a letter should be sent to the Director, U. S. Coast and Geodetic Survey, Washington, D. C., attention Section of Leveling, stating the necessity for moving the mark and giving its designation. The designation consists of the letters and numbers found to have been stamped with dies on the disk. It is desirable to furnish a rubbing of the disk as well. A rubbing can be made by placing a piece of medium-weight paper over the disk and then rubbing over the paper with a hard pencil to bring out the legend cast in the disk, especially the letters and numbers stamped on it with dies.

WILL SEND NEW DISK

Upon receipt of this information, this office will send out a new disk properly stamped to show that it has been reset. Necessary instructions for the establishment of the new mark and the transfer of elevation will also be sent. The proper procedure, in most cases, is to establish the new mark in a safe place nearby and transfer the elevation from the old mark to the new one by means of an engineer's level and rod. The levels should be run in duplicate to avoid the possibility of large errors, and all readings should be made to three decimal places in order to preserve the accuracy of the original elevation.

The old mark should not be disturbed until the observations involved in the transfer have been checked by the observer or the recorder. An assumed elevation for the old mark may be used in the transfer, since what we are primarily concerned with in a case of this sort is the difference in elevation between the old mark and the new one established to replace it.

After the new mark has been established and the elevation transferred to it, the old disk should be broken out and returned to this office in a franked mailing sack which will be supplied for the purpose. A complete report on the action taken, including a description of the location in which the new mark is established and a copy of the field notes involved in the transfer of elevation, should also be forwarded to this office; a franked envelope will be furnished for this purpose.

The cooperation which individuals and organizations may extend to this office in preserving the benchmarks will be a service not only to this bureau and other government surveying organizations but to anyone who may have occasion to use the marks.

HOWARD S. RAPPLEYE,
Chief, Section of Leveling,
U. S. Coast & Geodetic Survey.

Washington, D. C., Feb. 4, 1936.

Billboard Law Upheld

The efforts of the State Department of Public Works to enforce the provisions of the Outdoor Advertising Act receive deserved support from the decision of Superior Judge Welsh at Sacramento upholding the act.

Judge Welsh holds that the regulation of roadside signs is clearly within the State's police power to preserve the public peace, safety, morals and general welfare. The decision accords with rulings of courts in other States which have similar laws, and with decisions of United States courts in which such laws have been tested.

It is not known whether or not the case will be appealed thus giving the higher courts of California an opportunity to pass on the matter.

The decision has received much favorable comment from various newspapers and citizens interested in the beautification of highways.

Highway Development Curtailed By Diversion

Evidence that diversion of revenue from gasoline taxes and motor vehicle registration fees to nonhighway purposes tends drastically to curtail highway development is shown in studies comparing road progress made in the various states.

It has been found that Florida, Georgia, New York, and Texas, all of which have made a regular practice of diverting highway funds to other expenses, have made gains in their road mileage averaging only 66.8 per cent since 1928, whereas other states have showed an average gain of 92.4 per cent in the same period.

The percentage of improvement of highways in Florida was only 43.8, while that of New York was only 45. The percentage increase in Georgia was 71, and that of Texas 89.2.

Jibboom Street Grade Separation

(Continued from page 5)

tion of columns and piers. A 22,000 volt underground duct line, two 30-inch steel water mains, a 4-inch gas line, a 30-foot diameter water tank and numerous telegraph and signal lines are located in the railroad yard.

In the interests of economy, it was highly desirable to avoid shifting any of these facilities. Any expense incurred in this manner would naturally be chargeable to the total cost of the project. A suitable alignment and column location was finally selected that provides a minimum of interference.

Along the Old Pioneer Mill on the Jibboom Street unit, columns are spaced between loading doors so as not to interfere with freight loading operations. At one location on this approach, a huge rigid frame 69 feet long extending beyond the bridge deck on either side is necessary to span over four railroad tracks. Silicon steel, a special alloy of high strength, will be used in this frame to secure necessary resistance to the heavy loads applied. Full 22-feet vertical clearance is provided over all tracks.

APPROACH FILLS USED

Approach fills leading onto the bridge structure proper are used at the end of each approach unit. Economic studies were made to determine the proper distance to use this fill, beyond a certain height it being less expensive to construct piers and columns.

Considerable saving is effected in the bridge deck by using rolled steel beams and extending them over their supports as cantilevers. This arrangement causes a reduction in stress in the center of a span by transferring it to the support, thus permitting a substantial saving in weight of steel.

Rolled beams are cheaper than fabricated sections, requiring but little shop work to prepare them for use. This fact was satisfactorily reflected in the bids received for the Jibboom Street unit, and justified the selection of this method of design.

Headroom was at a premium over the two main line tracks and freight line crossovers immediately east of I Street bridge. In one instance a 36-inch rolled beam weighing 280 pounds per foot, one of the heaviest sections rolled, was necessary to support the load placed upon it. A deeper section would have been preferable, but 22 feet vertical clearance above the tracks left just enough space for this beam.

FORTY STATES LAY PLANS TO GEAR ROADS TO NEEDS

Federal authorities and officials of forty states are cooperating in plans under which State highway systems will be "tailored" exactly to fit the needs of citizens and industries in each state.

Under the State planning system, the idea that highways "just run from one place to another" is to be discarded as an obsolete relic of days when all highway vehicles were drawn by animals. Careful studies will be made in individual states to determine how existing highway systems must be adjusted to meet present-day conditions and those which may be expected to arise in the future.

Increased safety on highways, better use of money paid by motorists in special taxes and fees, construction of highways on the basis of traffic demands and adequate highway facilities for communities which lack other transportation services are among the benefits foreseen by officials of the Bureau of Public Roads, U. S. Department of Agriculture.

Preliminary arrangements for cooperation in making the studies have been initiated with ten other states.—*Highway Highlights.*

HIGHWAY SAFETY ENEMY AN "UNHOLY ALLIANCE"

The enemy of highway safety is "an unholy alliance," of outmoded highways, automobiles and traffic laws, and irresponsible drivers and pedestrians, Alfred P. Sloan, Jr., president of General Motors, said in an address at a luncheon of the National Safety Council to honor cities that won the fourth annual national safety contest.

"We now know what the enemy is—an unholy alliance of ancient and inadequate highways; automobiles that are too old for safe use—or that have been allowed to become old before their time; antiquated and conflicting laws; drivers and pedestrians who do not know—and all too often do not care whether they know—how to conduct themselves safely, considerately and courteously," he said.

Tower Span Wins in Beauty Contest

(Continued from page 8)

an appearance of massive strength that it indicates the need of a massive supporting structure. Actually the pier is much smaller than appearance indicates as the greater part of the tower loads come on the front leg of the tower and no pier or pedestal is used under the rear tower leg. All loads coming at that point are taken by the approach truss span. This arrangement of the fender system gives the proper balance and symmetry of design when viewed from the side.

UNIQUE PORTAL DESIGN

The curved portals over the roadway and at each intermediate panel point are a unique feature of the structure and add greatly to the aesthetic effect of the bridge from the viewpoint of the motorist as he travels over the roadway.

The massive abutments and pylons at each end of the bridge blend fittingly with the general proportions, color and natural surroundings of the structure. All steel members of the bridge, including the towers, are painted with aluminum paint which gives them a metallic luster.

For a distance of 2000 feet on the west approach to the bridge a beautification project was initiated to improve the appearance of that approach. This consisted of leveling all the area within the State right of way, installing a sprinkler system, planting small park areas immediately adjacent to the bridge and landscaping the approach by planting shrubs and trees.

The Tower Bridge, only bridge in the West to win an award, was built by the State Department of Public Works, in cooperation with the city and county of Sacramento and the Federal Government, at a cost of $994,000. The design and construction was under the direction of C. H. Purcell, State Highway Engineer, and F. W. Panhorst, Acting Bridge Engineer. The Division of Architecture cooperated in designing the architectural features of the structure.

Teacher—Who can tell me just what an island is?

Carl—It is a piece of land that went out for a swim.

Value of Better Roads for Farmers

WHAT is the value of improved roads to farmers? An answer to this question was sought in a survey conducted last summer by the New York State College of Agriculture, the results of which have been issued recently. A questionnaire was sent to a group of farmers, and in answering it each farmer was asked to place a reasonable value on his land and buildings. The farms were classified by the type of road running by —dirt, gravel or hard surfacing— and each farmer was asked to estimate the value of his land and buildings if the farm were on the other two types. A total of 3365 replies was received giving these comparisons; the average value of farms on dirt roads was $37 an acre, farms on gravel roads $55 and farms on hard roads $71. The farmers on dirt roads estimated, as an average, that their farms would be worth $45 an acre if the roads were gravel and $53 if the roads had hard surfacing. The farmers on gravel roads thought that their farms would be worth $45 an acre on dirt roads and $65 on hard roads. Those on hard roads estimated that their farms would be worth $47 on dirt roads and $57 on gravel. Combining these figures gives the following per-acre values: with dirt road, $43; with gravel road, $52; with hard road, $64. Thus the farmers considered it worth an average of $9 an acre to a farm to have a dirt road graveled and $21 an acre more to have a hard-surfaced road rather than a dirt road. On a total-farm basis it was worth $1,389 to have a dirt road graveled and $3,030 to have a dirt road hard-surfaced. Evidently, farmers in New York State place a considerable value on road improvement, although in certain sections where hard-road traffic is unusually heavy, a number of farmers indicated a preference for a farm on a gravel road.—*Better Roads.*

Contract has been awarded for surfacing of the State desert highway route 146 near the eastern boundary between Blythe in Riverside County and Palo Verde on the Imperial County line.

Oski: Make a sentence with the word "fascinate."

Wow-Wow: I have nine buttons on my shirt but I only fascinate.

BUILDING STATE HIGHWAY IN KINGS RIVER GORGE

By R. M. Gillis, District Engineer

THE completion last year of the thirty miles of the Generals Highway by the Federal Government to connect Sequoia and Grant parks has brought about an enormous increase in travel to this mountain area and has drawn public attention to the Kings River Highway work being carried on by the California Division of Highways.

The many people who make the trip to these two National Parks and then drive on from Grant down into the rugged gorge of the Kings River as far as the road is open, very naturally ask why this road is being built and where it is going.

Construction of the Kings River Highway was started in 1929 by the State of California in order to open an entirely new recreational area in the heart of the highest Sierra. Beginning at the north boundary of Grant Park the ultimate goal of this road is to reach the valley of the Kings River some twenty-six miles away.

COMPARES WITH YOSEMITE

While this valley does not have the water falls of Yosemite, the general characteristics are in many ways similar; it is about twelve miles long and from half a mile to a mile wide with an elevation of 4500 at the lower end and 5000 at the upper end. On each side of the valley are high granite cliffs, numerous streams coming in from the sides and grassy meadows with cedar and pine groves on the valley floor. Beyond the valley rise many peaks over twelve thousand feet high.

By this fall approximately eighteen miles of this new highway will have been completed and opened to the public, carrying the road through the roughest part of the Canyon of the Kings to Windy Cliff.

ROAD ALONG STREAM

From Windy Cliff the road will cross to the north side of the Kings and follow along the waters edge for a distance of eight miles to the lower end of the valley. Much heavy construction yet remains although none of it will compare with the portion now being finished.

All of this road is within the Sequoia National Forest, a National reserve of over 2000 square miles, which is now being extensively developed for public enjoyment by the Federal Government.

The United States Forest Service has already completed surveys and plans for the public use of the Kings Valley under its supervision and control as soon as this highway can reach it. The highway will never be carried further than the valley. Its completion will give access to one of the outstanding scenic and recreational areas of the State.

WM. T. HART APPOINTED HIGHWAY COMMISSIONER

(Continued from page 18)

in southern California equipped him with a wide knowledge of road building.

As chairman of the city, county and State Highway Committee of the San Diego Chamber of Commerce, Frank G. Forward long has led the fight to win for San Diego representation on the State Highway Commission. He welcomed the appointment to that body of Mr. Hart in a public statement in which he said:

"Governor Merriam's selection of William T. Hart of Carlsbad to be a member of the State Highway Commission is the most important step in realization of a completed coast highway through San Diego County and construction of a low grade route to Imperial County."

Mr. Hart is an active member of leading fraternal organizations having held offices in these orders, and also is an active member of various San Diego civic organizations.

He attended his first meeting of the Highway Commission in his official capacity in Long Beach on July 10th.

He—You are so wonderful, so beautiful, so marvelous, so—so—.

She—So what?

Heavy construction work necessary in the Kings River Canyon is shown at right where a retaining wall for the new highway is being built with granite boulders. Lower right shows completed retaining wall section. At lower left is scene after 74,450 pounds of explosives blasted away a mountain spur barrier on the line of the highway







Highway Bids and Awards for June, 1936

ALAMEDA COUNTY—At Niles, 6 undergrade crossing structures under Southern Pacific and Western Pacific railroad tracks, 1 bridge, and 2.9 miles graded and paved with P. C. C. and plant-mixed surfacing. District IV, Routes 5 and 107, Sec. CA. F. O. Bohnett & Co., Campbell, $482,272; Wood & Bevanda, Stockton, $486,903; J. F. Knapp, Oakland, $467,356; Guy F. Atkinson Co., San Francisco, $513,134; McDonald & Kahn Co.. Ltd.. San Francisco, $476,344. Contract awarded to Eaton & Smith, San Francisco, $453,169.82.

ALAMEDA COUNTY—Between Folger avenue and Camelia street, 2.4 miles, grade and surface with crusher run base and plant-mixed surfacing. District IV, Route 69, Section Emv. and Ber. Heafey-Moore Co., Oakland, $123,106; United Contr. Co., Portland, Ore., $126,673; Union Paving Co., San Francisco, $128,340. Contract awarded to Hanrahan Co., San Francisco, $122,538.70.

ALAMEDA COUNTY—Between Camelia street and San Pablo avenue, 3.1 miles, grade and surface with crusher run base and plant-mixed surf. District IV, Route 69, Sections Ber, Alb. A, Reh and E.Cr. Hanrahan Company, San Francisco, $224,573; Wood and Bevanda, Stockton, $278,888; Heafy-Moore Co., Oakland, $268,977; Peninsula Paving Company, San Francisco, $211,386. Contract awarded to Union Paving Co., San Francisco, $209,335.50.

ALAMEDA COUNTY—Between Irvington and Centerville, about 1.9 miles to be surfaced with plant-mix surfacing. District IV, Route 69, Sec. A. W. H. Larson, Oakland, $19,716; Independent Const. Co., Ltd., Oakland, $16,700; E. A. Forde, San Anselmo, $17,423; Lee J. Immel, Berkeley, $17,975. Contract awarded to Jones & King, Hayward, $16,295.

ALAMEDA COUNTY—In Oakland at Berkeley city line about 0.10 mile, grade and surfaee with plant-mixed surfacing. District IV, Route 206, Section Oak. Ransome Co., Emeryville, $10,255; Lee J. Immel, Berkeley, $9,989; W. H. Larsen, Oakland, $10,226. Contract awarded to Hanrahan Co., San Francisco, $8,197.20.

ALAMEDA COUNTY — Between 34th street and 7th street in the city of Oakland, 1.4 miles grade and pave with A. C. and P. C. C. District IV, Route 69, Section Oak. Peninsula Paving Co., San Francisco, $147,660; Union Paving Company, San Francisco, $142,559. Contract awarded to Hanrahan Company, San Francisco, $124,748.50.

CONTRA COSTA COUNTY—Between 2 miles west of Lafayette and Walnut Creek, 5.2 miles, grade and surface with plant-mixed surf. on er. run base. District IV, Route 75, Section A. Hanrahan Company, San Francisco, $359,152; John Carlin and Cranfield, Farrar & Carlin, San Francisco, $314,037; A. Teichert & Son, Inc., Sacramento, $328,169; Guy F. Atkinson Company, San Francisco, $329,876; George Pollock Company, Sacramento, $347,841; Wood & Bevando, Stockton, $361,814; D. McDonald, Sacramento, $328,329. Contract awarded to Union Paving Co., San Francisco, $293,291.

FRESNO COUNTY—Between Belmont Circle and Biola Junction, 4.5 miles to be graded and paved with P. C. C. and asphalt concrete. District VI, Route 4, Section Fre.&C. Union Paving Co., San Francisco, $235,897; Griffith Company, Los Angeles, $242,824; Wood & Bevanda, Stockton, $233,419. Contract awarded to Hanrahan Co., San Francisco, $229,510.55.

GLENN COUNTY—Between 4 miles north of Willows and 1 mile south of Artois, 1.5 mile to be graded, surfaced with crusher run base and plant-mix surfacing or widened and crusher run borders constructed, fences and reinforced concrete bridge to be constructed. District III, Route 7, Section B. A. T. Howe, Santa Rosa, $46,869; Leo F. Piazza, San Jose, $46,305. Contact awarded to N. M. Ball Sons, Berkeley, $43,671.65.

KERN COUNTY—Between 3 miles and 12 miles north of Mojave 9.1 miles to be surfaced with road-mix surfacing and seal coat. District IX, Route 23, Sec. B. M. J. B. Const. Co., Stockton, $26,363. Contract awarded to A. S. Vinnell Co., Los Angeles, $18,211.85.

KINGS COUNTY — Between westerly boundary and Kings River Slough. District VI, Route 10, Section B. A. S. Vinnell Co., Los Angeles, $15,131; John Jurkovich, Fresno, $14,555; Palo Alto Road Materials Co., Palo Alto, $13,244. Contract awarded to Stewart & Nuss, Inc., Fresno, $13,103.50.

LASSEN COUNTY—Between Susanville and Milford, and between Johnstonville and Lake Leavitt, 13.3 miles to be graded and treated with liquid asphalt. District II, Route 29, 73, Section C D, A. Isbell Const. Co., Reno, Nevada, $68,801; Larsen Bros., Sacramento, $65,373; A. Teichert & Son, Inc., Sacramento, $62,729; Harms Bros. Doyle, $58,789. Contract awarded to Fredricksen & Westbrook, Lower Lake, $58,442.50.

LOS ANGELES COUNTY—Between Patata street and Florence avenue, 1.1 miles widen roadbed and place widening strips of plant-mixed surf. and P. C. C. District VII. Route 167, Section A and Bell. Southern California Roads Co., Los Angeles, $33,960; C. F. Robbins, Los Angeles, $34,127; C. O. Sparks & Mundo Eng. Co., Los Angeles, $32,909; Oswald Bros., Los Angeles, $29,351; J. E. Haddock, Ltd., Pasadena, $30,039; Griffith Co., Los Angeles, $33,778. Contract awarded to Geo. R. Curtis Paving Co., Los Angeles, $28,526.20.

LOS ANGELES COUNTY—At Walnut Canyon about 0.6 miles to be graded and paved with P. C. concrete. District VII, Route 60, Section A. Gibbons & Read Co., Burbank, $54,177; J. F. Haddock, Ltd., Pasadena, $57,211; C. O. Sparks, & Mundo Eng. Co., Los Angeles, $52,603; Geo. R. Curtis Paving Co., Los Angeles, $53,506; R. E. Campbell, Los Angeles, $69,427; Oswald Bros., Los Angeles, $52,266; A. S. Vinnell Co., Los Angeles, $56,236. Contract awarded to C. F. Robbins, Los Angeles, $50,716.40.

LOS ANGELES COUNTY—A reinforced concrete girder bridge across Rio Hondo, 2 miles west of El Monte, 9-67' and 2-26' spans. District VII, Route 26, Sec. A. R. R. Bishop, Long Beach, $133,555; Daley Corp., San Diego, $132,749; Case Const. Co., Alhambra, $147,393; Carlo Bongiovanni, Hollywood, $130,858; Shofner & Gordon, Los Angeles, $143,146; Byerts & Dunn, Los Angeles, $129,852; J. E. Haddock, Ltd., Pasadena, $122,924. Contract awarded to Oscar Oberg, Los Angeles, $117,876.10.

LOS ANGELES COUNTY—At Rivera on San Gabriel boulevard, an undergrade crossing under tracks of A. T. & S. F. R. R. to be constructed. C. O. Sparks and Mundo Engineering Co., Los Angeles, $102,266; R. E. Campbell, Los Angeles, $115,277; Fred E. Potts Co., Los Angeles, $108,632; Daley Corporation, San Diego, $109,752; Shofner & Gordon, Los Angeles, $139,435; Oswald Bros., Los Angeles, $113,994; John Strona, Pomona, $107,511; Griffith Co., Los Angeles, $99,900. Contract awarded to J. E. Haddock, Ltd., Pasadena, $98,671.

MENDOCINO COUNTY—0.5 mile to be graded and timber bridges removed, between Gualala and Navarro River. District 1, Route 56, Section A, C. Guerin Bros., San Francisco, $7,695; J. V. Galbraith & Don A. Canevari, Santa Rosa, $8,664. Contract awarded to A. T. Howe, Santa Rosa, $7,470.50.

MENDOCINO COUNTY—Between Navarro River and Williams Creek, 0.8 mile to be graded and timber bridges removed. District 1, Route 56, Sec. D and E. J. V. Galbraith and Don A. Canevari, Santa Rosa, $18,301; Helwig Const. Co., Sebastopol, $19,737; M. J. B. Construction Co., Stockton, $20,205; N. M. Ball Sons, Berkeley, $24,099; A. T. Howe, Santa Rosa, $25,116; Leo F. Piazza, San Jose, $31,943. Contract awarded to Guerin Bros., San Francisco, $12,999.60.

MONTEREY COUNTY—Between San Lucas and King City, about five miles in length, seal coat to be applied to existing roadbed. District V, Route 2, Section F. L. A. Brisco, Arroyo Grande, Calif., $3,925; A. S. Vinnell Co., Los Angeles, $4,613. Contract awarded to Granite Construction Co., Ltd., Watsonville, $3,829.60.

MONTEREY COUNTY—Between Seaside Road and Castroville, about 12.2 miles in length, road-mix surface treatment to be applied to existing shoulders, District V, Route 56, Section 1. Lee J. Immel, Berkeley, $15,250; Oilfields Trucking Co., Bakersfield, $19,239. Contract awarded to L. A. Brisco, Arroyo Grande, $14,950.50.

ORANGE COUNTY—Between the north city limits of Brea and the Orange-Los Angeles County line, about 2 miles existing roadbed to be surfaced with plant-mix. District VII, Route 19, Sec. A. A. S. Vinnell Co., Los Angeles, $7,554; Goode & Schroeder, Los Angeles, $7,782; Paul R. Hughes, Long Beach, $10,480. Contract awarded to C. O. Sparks, Los Angeles, $7,067.50.

PLACER COUNTY—Between 4½ miles northeast of Tahoe City and Nevada state line, 7.1 miles to be graded and surfaced with plant-mixed surfacing on crusher run base. District III, Route 39, Section A. Union Paving Co., San Francisco, $179,288; Geo. Pollock Co., Sacramento, $192,072; J. A. Casson, Hayward, $196,596; Isbell Construction Co., Reno, Nevada, $218,338. Contract awarded to Hemstreet & Bell, Marysville, $163,069.

RIVERSIDE COUNTY—Between 12 miles east of Desert Center and 2.2 miles west of Blythe and between Routes 26 and 187, 12.5 miles in length, furnish and apply liquid asphalt. District XI, Route 64, 204, Section C, D, E-A. Gilmore Oil Co., Los Angeles, $4,797; Square Oil Co., Los Angeles, $4,925; Paulsen & March, Los Angeles, $4,619; Oilfield Trucking Co., Taft, $5,058; Morgan Bros., Huntington Park, $4,503; Lambs Transfer Co., Long Beach, $4,819. Contract awarded to Regal Oil Co., Long Beach, $4,155.30.

RIVERSIDE COUNTY—Between San Bernardino County line and Beaumont, about 2.4 miles to be graded and paved with plant-mix surf. District VIII, Route 26, Sec. A, Geo. J. Bock Co., Los Angeles, $80,603; Matich Bros., Elsinore, $77,546; Geo. R. Curtis Paving Co., Los Angeles, $65,410; R. E. Hazard & Son, San Diego, $75,966. Contract awarded to Oswald Bros., Los Angeles, $65,160.40.

RIVERSIDE COUNTY—Pit run gravel surfacing between Palo Verde and Route 64, near Blythe, 16.5 miles. District XI, Route 146, Section AB. Jack Starkenburg, Los Angeles, $14,025; Arthur C. Bussey, River-

Highway Bids and Awards for June, 1936

(Continued from preceding page)

side, $7,225; R. E. Hazard & Sons, San Diego, $10,455; V. R. Dennis Const., San Diego, $10,455. Contract awarded to Martin Bros. Trucking Co., Long Beach, $7,055.

SACRAMENTO COUNTY—Between C Street and American River, 0.6 mile, grade and A. C. and P. C. C. pavement. District III, Route 3, Sections Sac. and B. Heafey-Moore Co., Oakland, $53,399. Contract awarded to A. Teichert & Son, Inc., Sacramento, $49,772.95.

SACRAMENTO COUNTY—An overhead crossing over tracks of S. P. at Jibboom street in Sacramento. District III. Lindgren & Swinerton, Inc., San Francisco, $150,198; F. C. Amoroso & Sons, San Francisco, $136,987; Geo. Pollock Co., Sacramento, $149,888; M. B. McGowan, Inc., San Francisco, $142,956; A. Teichert & Son, Sacramento, $144,940. Contract awarded to Lord & Bishop, Sacramento, $136,962.60.

SAN BERNARDINO COUNTY—Between Colton and Waterman avenue, about 1.3 miles to be graded and paved with P. C. C. and A. C. District VIII. Route 26, Sec. E. Griffith Company, Los Angeles, $77,022; Daley Corporation, San Diego, $86,783; V. R. Dennis Const. Co., San Diego, $84,255; C. O. Sparks & Mundo Engr. Co., Los Angeles, $83,177; Dimmitt & Taylor, Los Angeles, $80,036. Contract awarded to Oswald Bros., Los Angeles, $71,273.20.

SAN BERNARDINO COUNTY—Near Colton, 3 reinforced concrete bridges across Warm Creek, Santa Ana River and an overflow channel; grade and pave approaches with P. C. C. District VIII, Route 26, Section E. Griffith Co., Los Angeles, $147,320; V. R. Dennis Const. Co., San Diego, $148,072; Bent Bros., Inc., Los Angeles, $145,989; John Strona, Pomona, $153,554; R. R. Bishop, Long Beach, $154,440; J. R. Haddock, Ltd., Pasadena, $149,723; Byerts & Dunn, Los Angeles, $138,542. Contract awarded to Daley Corp., San Diego, $128,392.60.

SAN BERNARDINO COUNTY—An overhead crossing over the A. T. & S. F. R. R. at Palm avenue, 3 miles south of Colton, and grade and pave approaches with plant mixed surfacing. Robert D. Paterson, Santa Barbara, $22,745. Contract awarded to John Oberg, Los Angeles, $21,136.

SAN BERNARDINO COUNTY—Between National Forest boundary and Victorville, 21 miles road-mix surf. treat. to be applied to existing roadbed. District VIII, Route 43, Sections J, K, L. Sou. Cal. Roads Co., Los Angeles, $29,562; Dimmitt & Taylor, Los Angeles, $27,028; Oilfields Trucking Co., Bakersfield, $24,549; Clyde W. Wood, Stockton, $27,945; Oswald Bros., Los Angeles, $28,192; A. S. Vinnell Co., Los Angeles, $22,423. Contract awarded to R. E. Hazard & Sons, San Diego, $22,391.25.

SAN BERNARDINO COUNTY—Between a point near Third street in Barstow and 0.6 mile easterly, 0.6 mile. Grade and treat with liquid asphalt. District VIII, Route 58, Section E. A. S. Vinnell Co., Los Angeles, $26,359; Dimmitt & Taylor, Los Angeles, $26,459. Contract awarded to Matich Bros., Elsinore, $22,891.60.

SAN DIEGO COUNTY—Between 6.5 miles east of Rincon and one mile west of Henshaw Dam, 9.2 miles in length, liquid asphalt to be furnished and applied. District XI, Route 195, Sections D and E. Oilfields Trucking Co., $4,473; Paulsen & March, $3,728; Gilmore Oil Co., $4,118; Square Oil Co., $3,506; Regal Oil Co., $3,311. Contract awarded to Morgan Bros., Huntington Park, $3,295.50.

SAN FRANCISCO COUNTY—In San Francisco at the 5th Street Plaza. Furnish and plant trees and shrubs, grade and plant lawn and furnish and install water system. District IV, Route 68, Section S, F. Rexroth & Rexroth, Bakersfield, $22,377; Walter A. Hoff, San Francisco, $24,506. Contract awarded to California Nursery Co., Niles, $13,935.

SAN LUIS OBISPO COUNTY—Portions between Toro Creek and Cambria, about 7.8 miles in length, shoulders to be road-mix surface treated. District V, Route 56, Sec. C. John Fesler, Santa Maria, $6,992; L. A. Brisco, Arroyo Grande, $7,484; A. S. Vinnell Co., Los Angeles, $6,570. Contract awarded to Oilfields Trucking Co., Bakersfield, $5,908.50.

SAN LUIS OBISPO COUNTY—Between Nipomo and Arroyo Grande (V-S.L.O.-20F), between Santa Maria River and Pismo (V-S.L.O.56-E), and between Edna and San Luis Obispo (S.L.O.-147-A), about 16 miles, seal coat and road-mix surface treatment to be applied. District V, Routes 2, 56, 147, Sections F, E, A. A. S. Vinnell Co., Los Angeles, $11,492; John Fesler, Santa Maria, $11,294. Contract awarded to L. A. Brisco, Arroyo Grande, $10,227.50.

SAN LUIS OBISPO COUNTY—Between Cambria and Route 2 (S.L.O.-33-D, E), between Morro and Shandon (S.L.O.-125-A,B,C), between Sta. Margarits and Creston (S.L.O.-137-A), about 41 miles in length, liquid asphalt to be furnished and applied. District V, Route 33, 125, 137, Section D, E, A, B, C, A. Lambs' Transfer Co., Long Beach, $11,398; L. A. Brisco, Arroyo Grande, $11,973; Oilfields Trucking Co., Bakersfield, $11,850. Contract awarded to Paulsen & March, Inc., Los Angeles, $11,343.60.

SAN LUIS OBISPO AND MONTEREY COUNTIES—Between Atascadero and San Miguel and between Salinas and Monterey-Santa Cruz county line, about 34 miles in length, seal coat to be applied to existing pavement. District V, Routes 2, 118, 56, Sections B, A, A, J. Lee J. Immel, Berkeley, $14,921; A. S. Vinnell Co., Los Angeles, $15,470. Contract awarded to Granite Construction Co., Ltd., Watsonville, $11,440.90.

SHASTA COUNTY—Between Viola and Forest Boundary, about 2.4 miles to be graded and surfaced with cr. run base and road-mix surf. District II, Route 20, Sec. E. Larsen Bros., Sacramento, $75,465; J. G. Chigris, San Francisco, $69,392. Contract awarded to Fredericksen & Westbrook, Lower Lake, $59,617.30.

SOLANO COUNTY—Fender construction, Rio Vista Bridge across Sacramento River. District X, Route 53, Section C. C. A. Lauritzen, Antioch. Contract awarded to Bundeson & Lauritzen, Pittsburg, $8,535.

STANISLAUS COUNTY—Between Turlock and Keyes, about 4.2 miles to be graded and surfaced with bit. tr. cr. grav. or stone (plant mix). District X, Route 4, Section A. Heafey-Moore Co., Oakland, $44,628; Pacific States Const. Co., San Francisco, $45,893; Biasotti, Willard & Biasotti, Stockton, $48,381; A. Teichert & Son, Inc., Sacramento, $48,378; M. J. B. Const. Co., Stockton, $54,405. Contract awarded to S. M. McGaw, Stockton, $44,163.50.

SUTTER COUNTY—Between Knights Landing and Robbins, 3.7 miles, grade and surface with cr. run base and road-mix surface. District III, Route 87, Section A. A. Teichert & Son, Inc., Sacramento, $99,454; Pacific States Const. Co., San Francisco, $92,220. Contract awarded to Hanrahan Company, San Francisco, $85,588.50.

TEHAMA COUNTY—At the south entrance to Red Bluff, about 0.3 miles in length to be graded and paved with P. C. C. pavement. District II, Route 7, Sec. B. Contract awarded to N. M. Ball Sons, Berkeley, $13,961.80.

TULARE COUNTY—Tulare to 7.6 miles south, 0.6 mile south to 2.8 miles north Goshen subway, subway to 0.7 mile west, road-mix surface tr. shoulders. District VI, Route 4, 10, Section B-F, A. Stewart & Nuss, Inc., Fresno, $6,814; Oilfields Trucking Co., Bakersfield, $6,760; Palo Alto Road Mtl. Co., Palo Alto, $7,104; L. A. Briscoe, Arroyo Grande, $6,742. Contract awarded to John Jurkovich, Fresno, $6,640.

TUOLUMNE COUNTY—Between 3½ miles east of Sullivan Creek and Pooleys, 24 miles, grade and surface with road-mix surfacing on Untr. Cr. Gr. or St. Base. District X, Route 13, Section C. Biasotti, Willard & Biasom, Stockton, $74,743; Union Paving Co., San Francisco, $68,466. Contract awarded to M. J. B. Construction Co., Stockton, $63,529.30.

VENTURA COUNTY—Between San Antonio Creek and Ojai and Mound School and 2.7 miles east and Simi 0.4 mile east of Santa Susana Overhead, 14.6 miles to be surfaced with plant-mixed surfacing. District VII, Routes 138, 151, 79, 9, Sections A, C. A. C. Geo. R. Curtis Paving Co., Los Angeles, $68,425; A. S. Vinnell Co., Los Angeles, $73,603; Oswald Bros., Los Angeles, $63,493. Contract awarded to Southwest Paving Co., Roscoe, $58,816.25.

VENTURA COUNTY—At Camarillo State Hospital, 1.5 miles to be graded and bit. treat. by the road-mix method. District VII, Route Camarillo State Hospital. C. F. Robbins, Los Angeles, $28,765; Oswald Bros., Los Angeles, $29,212; J. E. Haddock, Ltd., Pasadena, $30,090; A. S. Vinnell Co., Los Angeles, $27,047. Contract awarded to Dimmitt & Taylor, Los Angeles, $24,391.

YOLO AND COLUSA COUNTIES—Between Dunnigan and Arbuckle, 10.3 miles to be graded and surfaced with plant-mixed surfacing (medium curing type). District III, Route 7, Section C and A. Union Paving Co., San Francisco, $144,360; Hemstreet & Bell, Marysville, $159,921; A. Teichert & Son, Inc., Sacramento, $144,035. Contract awarded to Hanrahan Co., San Francisco, $129,708.50.

YOLO COUNTY—Between "M" Street Subway and Sacramento River Bridge, about 0.4 mile of P. C. C. widening strips to be constructed. District III, Route 6, Section C. N. M. Ball Sons, Berkeley, 9,520; L. C. Seidel, Oakland, $10,181. Contract awarded to A. Teichert & Son, Inc., Sacramento, $8,971.50.

YUBA and NEVADA COUNTIES—Between Parks Bar Bridge and one-quarter mile east of Nevada County line, 3.7 miles, grade and surface with crusher run base and seal coat. District III, Route 15, Sections B and A. Larsen Bros. & Harms Bros., Sacramento, $179,721; Isbell Construction Co., Reno, Nevada, $203,775; A. Teichert & Son, Inc., Sacramento, $202,978. Contract awarded to J. G. Chigris, San Francisco, $156,538.50.

A good speaker is one who says the things you would like to think of to say the way you would say them if you thought of them. —*Heron Lake News.*

Automotive engineers predict automobiles soon will be built that can travel ou land, sea and in the air. A better invention even than that would be an automobile that would travel on its own side of the highway.

"Are you positive," demanded counsel, "that the prisoner is the man who stole your car?"

"Well," anwered the witness, "I was until you cross-examined me. Now I'm not sure whether I ever had a car at all."

Safety in Double Strip Highway Modern Design Defies Obsolescence

IN AN ARTICLE dealing with modernization of obsolete sections of major highways recently published in Western Construction News, Lacey V. Murrow, Director of Highways of the State of Washington, says:

"To reconstruct obsolete primary highways and to bring them into condition to render the fullest and most satisfactory service to their users is the task confronting many a highway department. Assuredly, it is a task which in Washington we envisage and are moving steadily forward to accomplish. This does not mean the utter abandonment of the old roads. They simply cease to be main roads and become secondaries, serving the local territory through which they pass and furnishing connection to intersecting roads, etc.

"It may well be asked whether future years will not render obsolete the present high-standard construction in the same manner past years have dealt with past work. A definite negative answer can not as well be given to this question. The future is the future and keeps its own counsel.

CERTAIN PERMANENT FACTORS

"Nevertheless, it may be said that no future has ever or ever will render obsolete a straight line as the shortest path between two points; no future can ever make a second degree curve as awkward to negotiate as a twenty degree curve; no future can render obsolete good visibility once it is attained. In short, we can say confidently that what we are doing now in the reconstruction and reconditioning of our main highways is of a permanent, lasting character.

"This work may be refined in the future. It may be necessary to expand in the future. But it conforms with the major topographic features of the country traversed, with traffic needs, and with population centers. Therefore we do not expect obsolescence to deal with it as it has dealt with the work of 20 years ago."

Referring to certain sections of the Pacific Highway when relocation and reconstruction were required, Mr. Murrow describes the double strip type of highway adopted by the State Highway Department as follows:

"These sections were constructed with what has proved to be a most satisfactory type of heavy traffic road: two strips of 10-7-10-in. concrete pavement 20 feet wide with a 4-foot sodded neutral zone between them and with 9-foot shoulders on the outer sides. This requires a roadbed 62 feet wide on fills and 68 feet wide in cuts, the additional breadth being due to the side ditches in cuts.

"This double-strip pavement construction gives a complete two-lane pavement 20 feet wide to the traffic moving in each direction and, for normal highway uses, has a practically unlimited capacity. The 4-foot sodded neutral zone between the two pavements definitely divides the traffic streams and has a great psychological value in giving drivers a feeling of safety and security; oncoming traffic has its own pavement and must, or seemingly must, stay there.

NO HEAD-ON COLLISIONS

"This feeling of safety is a very real satisfaction to motorists and further increases the traffic capacity of the road. On the other hand should storm or accident temporarily close one strip of pavement the traffic can at any point be put under control, be taken across the neutral strip and detoured around the blockade.

"There is nothing imaginative about the increased safety afforded by the double strip construction. With it, passing another vehicle is accomplished without entering into the path and right-of-way of oncoming traffic. The temptation to take a chance in getting by a slow moving truck or a whole line of slow moving cars is eliminated by removing all hazard from the act. There has ceased to be any oncoming traffic to cause hazard and danger. Pass on curves if you want to.

"Illustrative of this safety is the fact that the records of our department show no instances of head-on collisions having occurred anywhere on the 70 miles of such road that we have built. On the other hand five lives have been lost and about $100,000 property loss has been suffered in recent years in head-on collisions on the 13 miles of single strip pavement still remaining in service east of Olympia.

In Memoriam

LAURENCE ADOLPHUS CHRISTENSEN, Junior Highway Engineer in District V of the Division of Highways, and employed on the San Simeon to Carmel highway in Monterey County, lost his life on June 18th. Following his daily custom, he had left his home in Pacific Valley in early morning and while driving to the construction camp at Anderson Canyon his car struck a deer and plunged over the side of the road, dropping two hundred and fifty feet to the ocean beach below. Other employees driving along the road a few minutes later noticed the skid marks and the body of the deer and upon investigation found Mr. Christensen lying beneath his car.

Mr. Christensen had been employed in the Division of Highways since December 12, 1928. For the greater part of that period he was engaged in construction engineering on the scenic Carmel-San Simeon highway on work for which his ability and experience had particularly fitted him.

Laurence A. Christensen was born in Newton, Utah, on July 12, 1884, and was fifty-two years old at the time of his tragic passing. He attended high school and was graduated from University of Utah in 1911 upon completion of his course in civil engineering. After graduation his employment in his chosen profession was very broad and varied. It included two years on railroad construction, ten years in design, construction and operation of irrigation projects and five years of general practice on dams, storm drains, street improvements and buildings.

His vocation carried him into many of the western states and brought him a wide acquaintance and many enduring friendships. Wherever he went he was ever conscientious in his duties, faithful and loyal in his employment. He leaves behind him in the Division of Highways many friends who have associated with him and have been charmed by his quiet and genial character. In his passing he leaves his widow and aged mother, two brothers and three sisters.

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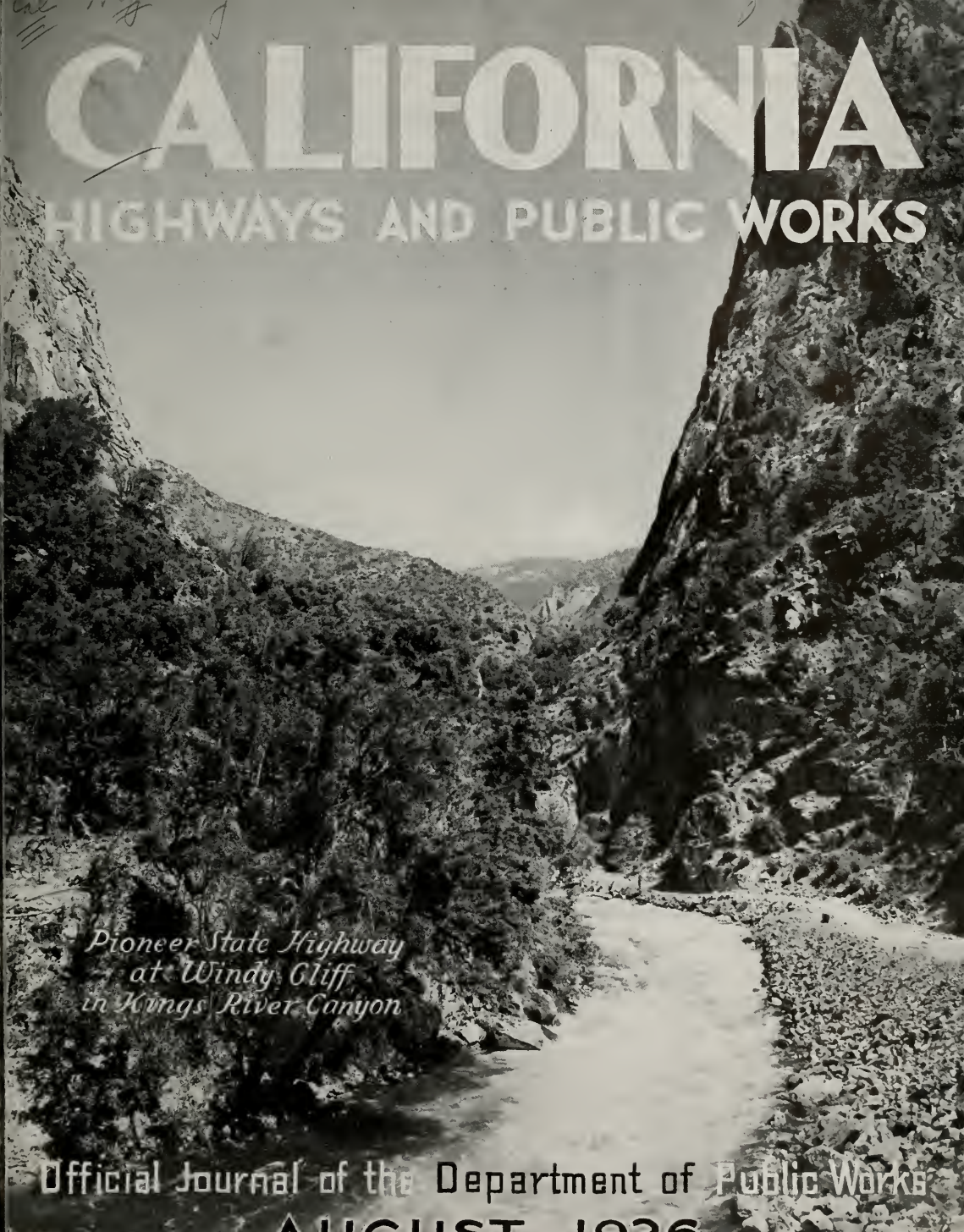
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CALIFORNIA

HIGHWAYS AND PUBLIC WORKS



Pioneer State Highway at Windy Cliff in Kings River Canyon

Official Journal of the Department of Public Works

AUGUST 1936

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CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways of the Department of Public Works, State of California

EARL LEE KELLY, Director C. H. PURCELL, State Highway Engineer JOHN W. HOWE, Editor

Published for information of the members of the department and the citizens of California

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AUG 27 1936

$5,917,525 of Gas Tax Allocated to Cities for Last Fiscal Year

By NEWTON PRATT
Assistant Engineer of City and Cooperative Projects

WITH the apportionment of gas tax revenue for the fiscal year ending June 30, 1936, complete, the incorporated cities of California will receive $5,917,525.07 for this period according to the official apportionment recently announced by the Department of Public Works through the Division of Highways.

Of this amount, $3,350,101.11 is provided for expenditure upon designated State highway routes within municipalities, while the remaining $2,567,423.96 will be expended upon streets of major importance other than State highway routes.

This apportionment, combined with $5,291,693.72 allotted to the cities from gas tax revenue accrued during the preceding 1933–1935 biennium, brings the cities a total subvention from the gas tax to date of $11,209,218.79, exclusive of State highway funds appropriated by the California Highway Commission for expenditure within municipalities.

Considered upon a biennial basis, the cities will receive approximately $6,748,800 more when the concluding apportionment of the current biennium is made next April.

The apportionment was made under laws enacted by the Legislature of 1935 and represents the net proceeds of ½ cent of the gas tax, of which ¼ cent is allotted for State highway routes and ¼ cent is allotted for streets of major importance.

While the law allots an equal amount, or ¼ cent of the gas tax for each purpose, the apportionment for State highways for the last fiscal year is necessarily greater than the amount allocated for other city streets due to the effective date of the enactment covering the latter apportionment occurring on September 15, 1935, subsequent to the July or initial quarterly apportionment thereby depriving this allotment of the revenue accruing from the first quarter.

As the allocation for State highways was originally created by the 1933 Legislature with August 21, 1933, as the effective date, this legislation had the priority to share in the July and succeeding three quarterly apportionments of the fiscal year.

The 1935 legislation as coded under sections 194 to 203 of the Streets and Highways Code was nominally an amendment, or more practically an extension, of the original enactment under Chapter 767, Statutes of 1933, whereby the Department of Public Works was charged with the duty of expending ¼ cent of its 2-cent share of the gas tax upon designated State highway routes within the incorporated cities of the State upon a proportionate population basis.

The amendment continued this allocation under section 203 and allotted an additional ¼ cent of gas tax revenue under section 194 of the Streets and Highways Code for expenditure upon streets of major importance other than State highway routes.

How $5,917,525 Gas Tax Was Divided Among Highway Districts*

	District Headquarters	State Highway	Streets of Major Importance
District I	Eureka	$24,403 85	$18,691 63
District II	Redding	16,184 22	12,406 44
District III	Marysville	121,173 89	92,814 43
District IV	San Francisco	1,080,382 15	827,859 36
District V	San Luis Obispo	69,701 47	53,414 48
District VI	Fresno	114,761 11	87,901 02
District VII	Los Angeles	1,564,068 14	1,198,624 31
District VIII	San Bernardino	104,113 54	79,913 23
District IX	Bishop	905 26	693 37
District X	Stockton	89,903 40	69,105 90
District XI	San Diego	164,504 08	125,999 79
Grand totals		$3,350,101 11	$2,567,423 96

* Allocations to cities in each highway district shown on pages 16-19.

(Continued on page 15)

Angeles Crest Link Completed by U. S. Bureau

By RALPH C. MYERS
Assistant District Office Engineer

A NEW LINK in the scenic Angeles Crest Highway has just been finished by the United States Bureau of Public Roads, bringing the completion of this route another step nearer its ultimate realization. The construction of this portion by the U. S. Bureau of Public Roads was done in accordance with a cooperative agreement between the Federal Government and the State of California.

Beginning at the Foothill Boulevard in La Canada the Angeles Crest Route extends up the Arroyo Seco and is projected through the mountains with the easterly terminus in Los Angeles County Park at Big Pines, a popular recreational area now accessible only by way of Palmdale or San Bernardino.

SAVES 43 MILES TRAVEL

Both of these routes are indirect as compared to the proposed Angeles Crest Route, the shortest present routing from Los Angeles to Big Pines being 107 miles in length, while the distance by the Angeles Crest Highway will be approximately 64 miles, a saving of 43 miles.

Aside from the 40 per cent saving in distance, an added advantage of the new route will be that it traverses territory far more scenic and more heavily timbered than either of the present routes.

The contract recently completed under the supervision of the U. S. Bureau of Public Roads extended from Tujunga Saddle near State Convict Camp No. 31, northeasterly for 4.1 miles to Charlton Flats, and covered construction in a hitherto isolated portion of the Sierra Madre range, lying northerly of Pasadena, a section which has been accessible only by a narrow, steep and tortuous forest service road which was not open to the public.

The greater part of the bureau's contract involved heavy grading, the construction of the 30-foot roadway necessitating 324,000 cubic yards of excavation. The cost of this U. S. Government contract was approximately $230,000, and although it does not at present connect directly with the rest of the Angeles Crest Route, except by temporary forest service road to Red Box via Barley Flat, it is nevertheless built to the standards set for the route and is an integral part of the Angeles Crest Highway.

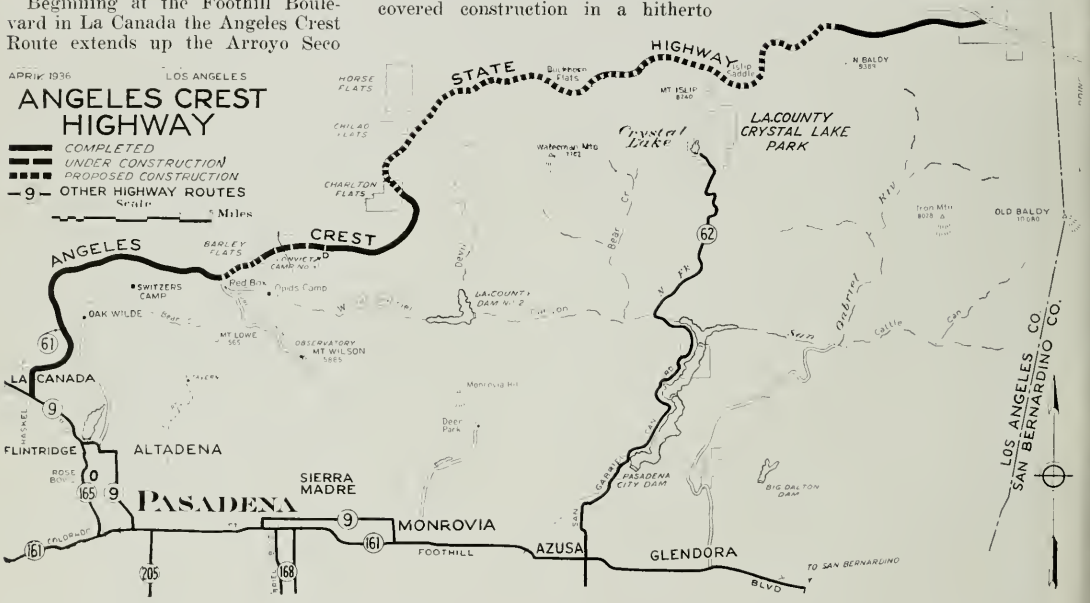
JOINS STATE PROJECT

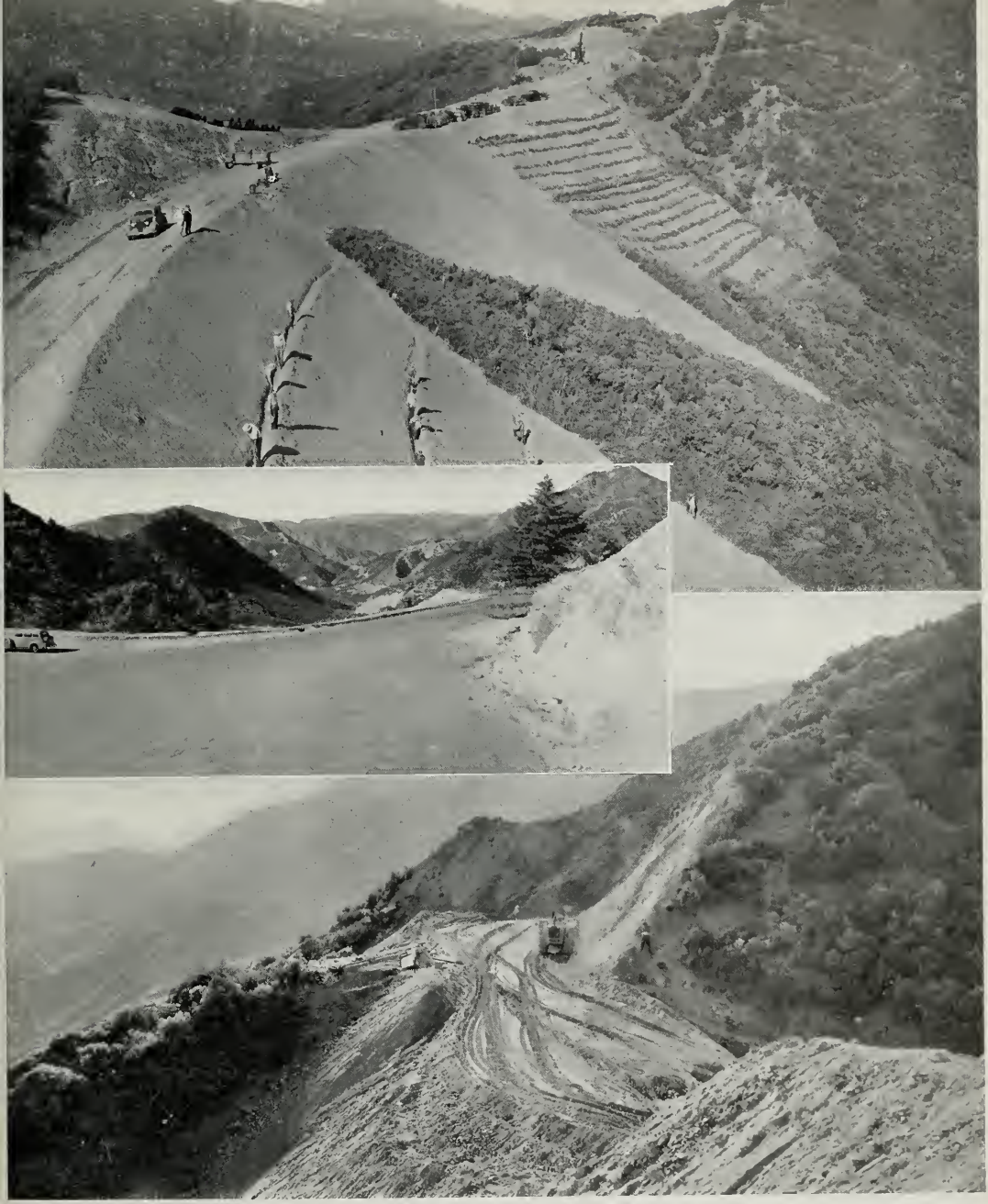
Joining this section on the west is a project 2.92 miles in length, which is being constructed by the State with prison labor from San Quentin Prison. The portion to be constructed by prison labor will, in time, be joined on its westerly extremity with the completed portion of the route at Red Box by a 1.3 miles section which is proposed to be placed under contract in the near future by the U. S. Bureau of Public Roads, using U. S. Forest highway funds.

It is planned to continue work with this convict labor for a section of nearly three miles in length extending from the end of the recently completed U. S. Bureau of Public Roads contract westerly toward La Canada.

In addition to the use of convict

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Construction scenes on a new link of the Angeles Crest Highway recently completed by the U. S. Bureau of Public Roads are shown in the upper and lower pictures. Extensive planting operations are seen under way, at top, to prevent erosion on fill slopes. The rough, precipitous character of this section of the Sierra Madre mountain range lying north of Pasadena is shown in the bottom picture where equipment is at work constructing a fill. The center inset shows a completed portion of the highway.



View of proposed Arroyo Seco Parkway location looking up stream from Avenue 26, Los Angeles, toward Pasadena. Bridge in center of picture is Cypress Avenue bridge of Union Pacific Railroad. Route of proposed parkway follows along left side of wheel tracks in foreground.

ARROYO SECO PARKWAY WILL INCLUDE A SIX MILE DOUBLE LANE DEPRESSED ARTERIAL

By S. V. CORTELYOU, District Engineer

WITH the commencement of construction of the North Figueroa Street viaduct in Los Angeles and development of plans for necessary highway work by the State Division of Highways and the three cities involved, the long dreamed of Arroyo Seco Parkway in the cities of Los Angeles, South Pasadena and Pasadena approaches realization.

The parkway will provide a direct nine-mile highway link between the business districts of Los Angeles and Pasadena, and will serve Highland Park, South Pasadena, San Marino and Altadena, and other northern and northeastern sections of Los Angeles County.

PARKWAY JOINS VIADUCT

The great $578,420 viaduct, 883 feet long, being built from the north portal of the most northerly of the four Figueroa Street tunnels over the railroad tracks, Los Angeles River and San Fernando Road is designed as the southern terminus of the picturesque parkway, which for 4.5 miles will follow the Arroyo Seco and three miles farther to a connection with Colorado Street, State Route 161, in Pasadena, at Broadway.

Plans for the parkway call for a minimum ultimate width of eighty feet, with a thirty-four-foot roadway at either side of the central parking.

The proposed parkway leaves Figueroa Street between the north end of the Figueroa Street viaduct and Avenue 22.

DRIVEWAYS SEPARATED

The parkway section, with the double driveway with a separate lane for traffic in each direction, will extend from this point near Avenue 22 to Glenarm Street at the south end of Broadway in Pasadena, a distance of approximately six miles.

From Glenarm Street the route follows northerly to Colorado Boulevard by way of Broadway, which is 90 to 100 feet wide. Broadway is now improved adequately to take care of the large volume of traffic which will use this route.

At the southerly end, traffic which uses the parkway will have easy access into and through the center of Los Angeles by way of the Figueroa Street tunnels and Figueroa Street. Access to the business center will also be had by way of Castelar Street, Broadway, North Spring, and other streets.

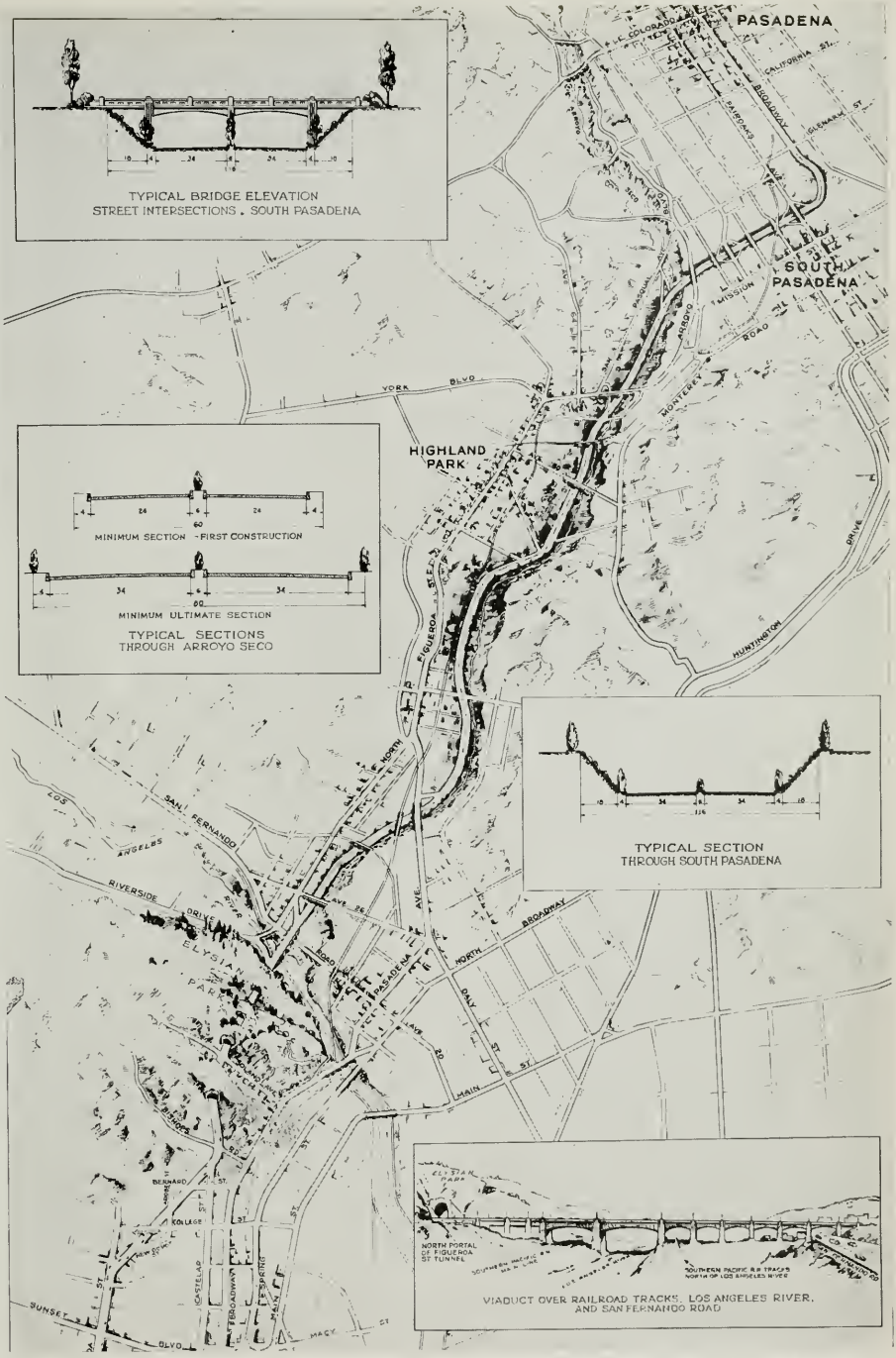
CONTINUOUS TRAFFIC FLOW

This double-laned parkway will provide the quickest, most convenient and safest means for vehicular traffic to flow between Los Angeles and points to the northeast. The saving in time to motorists is based not upon the traffic flowing at unduly high speeds, but upon its ability to flow continuously at reasonable speeds without the usual delays caused by intersecting streets.

In the six-mile section between Avenue 22 and Glenarm Street there are only two streets that cross the parkway at grade: Avenue 52 and Hermon Avenue, both of them comparatively unimportant. In addition to these two streets, access to the parkway between Avenue 22 and Glenarm Street is proposed at Loretto Street, Avenue 36, Avenue 43, Avenue 57, Shults Street, Saloniea Street, and Hough Street in Los Angeles, and at Orange Grove Avenue and Fair Oaks Avenue in South Pasadena.

At the two latter points the present

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This bird's-eye view of the proposed Arroyo Seco Parkway shows the course the projected quick traffic road will follow from the Figueroa Street tunnels in the city of Los Angeles along the depressed channel of the Arroyo Seco to South Pasadena and connecting with Broadway leading into Pasadena. Construction of the viaduct over railroad tracks, the Los Angeles River and San Fernando Road approaching north portal of the Figueroa Street tunnel is now in progress under supervision of the State Department of Public Works. The new highway will facilitate traffic between Los Angeles and Pasadena and northern and northeastern sections of Los Angeles county.

Courtesy Automobile Club of Southern California

How San Marcos Pass Saved California to U. S.

ON A KNOLL overlooking Sisquoc Valley in Santa Barbara County is a little gray church and back of it, is a small cemetery in which sleeps the man, Benjamin Foxen, whose discovery of San Marcos Pass on the route of the present State highway through the Santa Ynez Mountains changed the destiny of California, and prevented this State from becoming a British colony.

Some 25 miles southwest a splendid State highway such as this man never visioned winds through Gaviota Pass, and twenty miles south as the crow flies is San Marcos Pass through which a scenically beautiful State highway recently completed, at a cost of $420,000, ascends the Santa Ynez Mountains along Foxen's pioneer trail and leads to fertile valleys beyond wherein lived the man who rests at Sisquoc and where came to him ninety years ago the opportunity to decide the fate of California.

Sisquoc, Gaviota Pass and San Marcos Pass loom large in the history of the Golden State and the modern highways that now link them once were rugged trails over which this man tramped in his pioneering and whose knowledge of them had much to do with the success of American occupation of California.

SAVED FREMONT'S BATTALION

It was Benjamin Foxen who saved John C. Fremont and his ragged, march-weary battalion from annihilation in Gaviota Pass and showed him the way through San Marcos to a bloodless conquest of Santa Barbara during Christmas week in 1846, a victory that some historians believe forestalled the armed annexation of California by the British.

Of the many thousands of motorists that each year travel over El Camino Real, the Coast Highway between San Francisco and Los Angeles, and the San Marcos Highway, few give a thought to the historical importance of Gaviota gorge, "The Pass of the Gulls," and of San Marcos Pass, which was the salvation of Fremont and, perhaps, of California.

Fewer still realize that a few miles from these two great roads is the little gray church of Sisquoc and its cemetery where rest Benjamin Foxen and many of his kinsfolk and friends of long ago, and that nearby is a monument of enduring granite erected in honor of the memory of General Fremont and Foxen.

SHRINE FOR PILGRIMAGES

The people of Santa Barbara County know and they are making of the church a shrine to which annual pilgrimages will be made. Several such pilgrimages already have been made. The last one was on June 20th and the number of persons participating has given rise to hopes that the little house of worship, planned by Benjamin Foxen and to which Franciscan Mission friars were wont to go many years since to preach to their flocks, to celebrate marriages and baptisms and to bury the dead, will in the future become a cherished historical landmark.

Inspired and led by R. E. Easton of Santa Barbara, a group of citizens of Santa Barbara County on July 30, 1933, rededicated the old Sisquoc chapel. Franciscan padres from Old Mission Santa Barbara took part in the services singing a sonorous old Spanish mass brought to California by Fr. Junipero Serra and his brother friars. With Frank J. McCoy and C. L. Preisker of Santa Maria, Father Augustine Hobrecht of Mission Santa Barbara, Daniel A. Sattler of Santa Barbara and Robert A. Wickenden of Los Alamos, a grandson of Foxen, Easton determined to make the memorial ceremonies an annual event and three pilgrimages under his guidance have been made to the Sisquoc church.

The chapel and its three-acre churchyard and cemetery have been presented to the public by the Santa Maria branch of the Security First National Bank of Los Angeles.

This year, as he did the year before, Father Augustine preached the sermon at the old chapel and with him were choristers and priests from his mission. In keeping with early California traditions, Easton each year is host at a barbecue on his ranch in Sisquoc Valley.

Isolated for so long, neglected for decades, the tiny church of Sisquoc, now reached by excellent paved State roads, has been restored and enters upon a new era deserving of the reverence of a great State.

For years before he died, Foxen had desired to erect a church on his Rancho Tinaquaic in the valley of the Sisquoc in order that those of the Catholic faith on the widely scattered ranches of the district might have a place to worship God. He did not live to see his dream materialize. He died in 1874. But knowing his wishes in the matter, the Catholic families who had been his neighbors built the little church in 1875.

Lumber for it was hauled 35 miles inland from Point Sal by Fred Foxen, a son of Benjamin, and he and his brother, Thomas, and Chris Clausen, a carpenter, erected the church.

HISTORIC MONUMENT ERECTED

The following year, the coffin containing the remains of Benjamin Foxen was taken from its grave in the valley and removed to the church cemetery overlooking the vast domain that once was his. Foxen had been a seafaring man before he settled in California and a tall marble shaft, carved to represent a broken ship's mast, was placed at the head of his last resting place. On the tombstone is this simple inscription:

"Benjamin Foxen. Born in England in 1796. Died February 19, 1874."

Down Foxen Canyon, winding away from the little church to Zaca and its junction with the Coast Highway, is a monument of another sort, an imposing granite pile. On it is a bronze plate with these stirring words:

SANTA BARBARA COUNTY
Dedicates This Monument To
JOHN C. FREMONT BENJAMIN FOXEN
The Pathfinder The Pioneer

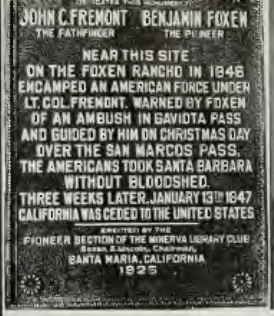
NEAR THIS SITE

ON THE FOXEN RANCHO IN 1846 ENCAMPED AN AMERICAN FORCE UNDER LT. COL. FREMONT. WARNED BY FOXEN OF AN AMBUSH IN GAVIOTA PASS AND GUIDED BY HIM ON CHRISTMAS DAY OVER THE SAN MARCOS PASS, THE AMERICANS TOOK SANTA BARBARA WITHOUT BLOODSHED. THREE WEEKS LATER, JANUARY 13th, 1847, CALIFORNIA WAS CEDED TO THE UNITED STATES

Erected by the
Pioneer Section of the Minerva Library Club, Susan E. Lincoln, Chairman
Santa Maria, California
1926

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Scenes and characters figuring in dramatic story of San Marcos Pass and Gaviota Pass. Upper row—Gaviota Pass in 1912. Inscription on Fremont-Foxen monument and Benjamin Foxen. Center row—Sketch map of old Foxen ranch and route over which Foxen guided Fremont to San Marcos Pass. Restored Sisquoc church. Lower row—Monument at grave of Foxen. Section of new San Marcos Pass State Highway. Mrs. Maria Antonia Foxen Cooper, daughter of Foxen; Benton Fremont, grandson of John C. Fremont; Mrs. Matilda Foxen Carteri, daughter of Foxen, at Fremont-Foxen memorial monument.



San Marcos Pass relocation construction presented much tough going for highway builders through rugged terrain of Santa Ynez Mountains.

HOW SAN MARCOS PASS SAVED CALIFORNIA TO THE UNITED STATES

(Continued from page 6)

In Santa Barbara County today are many descendants of Benjamin Foxen. All revere his memory. His grandson, Robert Wiekenden, and the latter's wife, Mrs. Ida Wiekenden, delight to relate stories about the pioneer hero which they heard as children from Grandpa and Grandma Foxen.

The story of Benjamin Foxen, inextricably a part of the history of Fremont and his conquest of California, is one of absorbing interest and always will bear repetition.

TOOK SPANISH WIFE

Foxen came to California as a sailor from England in 1827 and settled at Goleta on the Santa Barbara coast not far from where the San Marcos State Highway leaves El Camino Real for the route over the Santa Ynez Mountains. Here, as a partner of Don Jose de la Guerra y Noriega, he engaged in trading and shipbuilding. He married Eduarda Osuna, deseended from the Counts of Osuna of Spain. They were married in Mission Santa Barbara and Foxen was baptized in the faith of his wife, the padres giving him the baptismal name of William Domingo Foxen. But throughout his life he was called by his friends and neighbors Don Julian.

Foxen obtained a large grant of land known as Rancho Tinaquaie and built an imposing adobe ranch house at the head of Foxen Canyon. An Eglishman by birth and bound to the Californians by his marital ties, Foxen held aloof from the contest for California waging between the Russians, British and Americans.

To Rancho Tinaquaie one dreary day in late Deeember, 1846, came Lieut. John C. Fremont with a battalion of ragged, starving buckskin-elad soldiers and Indian guides. Fremont was marehing south to eapture Santa Barbara. He had been directed to the Foxen ranch by William Goodwin Dana, father of Don Juan Franeiseo Dana of Nipoma. Juan Dana died last July 27th at the age of 98 years. Only a few weeks before he had celebrated his birthday surrounded by friends to whom he recounted memories of Fremont, who often had held him in his lap when he was a lad and Fremont stopped at the Dana raneh.

PLAN TO AMBUSH FREMONT

It was Fremont's intention to stop at Tinaquaic, rest his troops and horses and fill their stomachs, and then mareh south through Gaviota Pass to Santa Barbara. Now, Foxen, through his wife, knew of the plans of the Californians to wipe out the Americans in Gaviota gorge.

"The Pass of the Gulls" then was a narrow defile between high rock eliffs. A wagon barely eould pass between the granite walls. Fremont's mounted men would have had to pass two abreast through the gorge. The Californians and their Indian supporters were assembled here in hiding. They planned to let Fremont's battalion enter the pass and then by blasting with gunpowder hurl the eliffs down upon them. Had the Gringo soldiers gone this way to Santa Barbara they would have been wiped out to a man.

Foxen was well aware of this plan. Torn between love for his wife and her people and what he believed to be his duty to the doomed Fremont, Foxen kept the Amerieans at his ranch for days, feeding them well, and providing them with hides and material wherewith to fashion new elothes and foot gear. A sincere affeetion for eaeh other sprang up between Fremont and the pioneer.

BRITISH WANTED CALIFORNIA

Somewhere off shore two British men-of-war were heading for Santa Barbara, and historians say that negotiations had been entered into between the Californian leaders and the English for the surrender of Santa Barbara and California. It is difficult to overestimate the disaster to American ambitions that would have resulted had Fremont and his men been annihilated in Gaviota Pass.

Finally, Fremont was ready to start for Santa Barbara. He was not aware of the fate that awaited him in Gaviota Pass. He believed that there was no other way to reach Santa Barbara, which he expected to take in

(Continued on page 30)



Grade separation under construction at Calwa, near Fresno, on U. S. 99, is 1740 feet over all with cantilevered sidewalks.

Calwa Overpass Will Assure Safety for U. S. 99 Traffic

COMPLETION of the Calwa Overpass late in September will eliminate another dangerous highway grade crossing. The site of this overpass is some three miles south of Fresno where The Atchison, Topeka, and Santa Fe main line crosses U. S. Route 99. High board fences and buildings obscured the view of approaching trains and created virtually a blind crossing. Heavy fogs in the winter added to the hazard.

The approaches to the crossing for several miles in either direction are straight and level stretches encouraging higher traffic speeds than are normally encountered at other main line crossings.

Traffic count on this section of highway has been well over 8000 cars a day. Railroad traffic during the greater part of the year is normally twelve trains daily, but during the peak fruit season in September and October some seventy to eighty trains a day are operating or switching back and forth over the crossing. As a result of this heavy schedule, the traveling public suffered no end of annoyance and delay and at times cars were often backed up as much as a mile on either side of the intersection.

The need for a grade separation at Calwa was recognized back in May, 1929, when preliminary surveys for a structure were undertaken, but due to lack of funds no action was taken on the project until in 1935, under the Emergency Relief Appropriation Act, the Works Program grade crossing fund was created, and through the California allotment of this fund, the present separation was made possible.

Plans were drawn and bids called for on December 4, 1935, and the contract was awarded in January, 1936.

The roadway over the Calwa Overpass is forty-four feet wide and is bordered on each side by a cantilever sidewalk. Ample space is provided for four lanes of traffic. The overall length of the structure is 1740 feet, the approaches being made on 5 per cent grades with connecting vertical curves and insuring a sight distance of 600 feet.

The superstructure consists of twenty-eight forty foot reinforced concrete girder spans, five skewed spans adjacent to the railroad span, and one central skewed steel span over the railroad which is long enough to provide room for an additional future track. It was originally planned to rest the column footings on timber piles, but after a series of borings and bearing tests, it was determined that piles were unnecessary, thereby effecting a considerable saving in the cost of the project. During construction, traffic was handled on a twenty-three foot detour just west of the structure.

NEW METHODS USED

Several innovations in construction methods and procedure were used in the building of the overpass. The ordinary timber falsework was replaced on this project by especially constructed steel falsework trusses. These trusses were used in the erection of the twenty-eight standard spans and made possible a very accurate

(Continued on page 14)

Pan-American Highway a Great Mexican Achievement

By
EARL LEE KELLY
Director of Public Works

THE Pan-American Highway between Laredo, Texas, and Mexico City, recently completed by the Department of Public Works of the Government of Mexico, is a road that measures up to the best modern standards of highway construction in the United States.

On the occasion of the recent official dedication of the highway, Thos. H. MacDonald, Chief of the U. S. Bureau of Public Roads, expressed himself as most favorably impressed with the high standard of construction, particularly through the difficult mountain area between Tamazunchale and Pachuca.

Almost every conceivable obstacle involved in the making of highways was encountered and overcome by engineering skill in the 765 miles of roadbed stretching from the Rio Grande to the capital of Mexico.

COST UNDER $20,000,000

Mountains were scaled on easy grade, rivers and streams bridged and jungle growth leveled with machetes in the hands of sweating laborers in order to create one of the greatest highways in the Western Hemisphere.

For sheer scenic beauty the Pan-American Highway rivals any motor road in the world. It required more than ten years to build it and the cost was only sixty-two million pesos. That is less than twenty millions of American dollars. Cheap man power made it possible to accomplish the gigantic task for that amount of money.

It is said that the 1,610,000 cubic yards of broken stone that was used in the foundation of the 765 miles of highway were cracked by hand by an army of Mexican toilers.

An example of the magnitude of certain portions of the job is apparent between Tamazunchale and Jacala, a distance of sixty-four miles. Preliminary surveys of this section required three years of work by engineers and hundreds of Mexican laborers.

CHISELED OUT OF CLIFFS

Between these two points and for forty miles south of Jacala the highway, thirty feet wide, was chiseled out of almost solid, perpendicular rock cliffs. Surveyors with their transits were lowered down the sides of these cliffs with ropes and when actual construction began laborers with picks and shovels worked with ropes tied about them and securely fastened to trees high above. For this one stretch more than 4,000,000 cubic yards of material, most of it rock, was excavated by hand.

When we viewed this stretch of completed road I was reminded of the job that our own Division of Highways is doing on the Feather River Highway, particularly at Grizzly Dome, that monumental pile of granite in the Feather River Canyon along the face of which will run the new highway.

REPRESENTED GOVERNOR MERRIAM

It was my pleasure to represent Governor Frank F. Merriam and the State of California as a member of the American delegation which last month participated with official representatives of the Mexican and Guatemalan governments in the inauguration of the Mexico City-Laredo Highway. With George T. McCoy, Assistant State Highway Engineer, I joined the American delegation, headed by Vice President John Nance Garner, at Laredo on July 1st.

The Mexican and Guatemalan delegates assembled at Nuevo Laredo across the Rio Grande. Following a breakfast tendered us by the Chamber of Commerce of Laredo we went to the center of the International Bridge, the boundary line, and there met the delegations from the two southern republics. An address of welcome was delivered by General Eduardo Hay, Secretary of Foreign Relations, representing the President of Mexico, to which Vice President Garner responded.

At the conclusion of the speech making, a Mexican band played our national anthem and an American band rendered the national anthem of Mexico after which the combined party proceeded to Nuevo Laredo, where entertainment and refreshments were offered. At 11 o'clock on the morning of July 1st a caravan of automobiles carrying the delegations and Mexican officials and preceded by a motorcycle squadron headed south for Monterrey, which we reached at 2 o'clock in the afternoon.

Monterrey is 145 miles distant from the Mexican custom house at Laredo and the first 45 miles of the highway runs in a true and straight line, tempting drivers to speed, but the limit is 50 miles an hour.

CLIMBED EASY GRADIENT

Between Laredo and Sabinas Hidalgo, 75 miles south, lies one of the richest sections of farm land imaginable and we were told that ninety per cent of it remains untouched by the plow. Charmed by the level plain we had traversed, we were hardly prepared for the sudden change in the terrain beyond Sabinas Hidalgo.

Without realizing it we suddenly found we had ascended to 3000 feet above sea level and below us lay a beautiful panorama of the level plain we had left, dotted with lofty hills. Quite as abruptly we dropped down the grade, passed through a rugged canyon and were in Monterrey.

Here the mayor of the city received us and after welcoming ceremonies we were taken on a sightseeing tour. The delegations had dinner and enjoyed a serenade at Chipinque that night as guests of the Governor of the State of Nuevo Leon. Departure was taken from Monterrey at 9 o'clock the following morning.

Monterrey is an industrial city, producing steel, flour, glass, cotton goods and other commodities, and its mills are in striking contrast to the mountains and plains surrounding it.

LOW MOUNTAIN GRADES

Leaving Monterrey the motoring visitor gains the impression that stiff mountain climbing lies ahead. However, the highway follows low grades through the range and there is a stretch of 178 miles of almost level pavement to Ciudad Victoria. The country and the people along this section of highway are primitive, thatched huts, oxcarts and crude farm

(Continued on page 24)



Delano Underpass recently opened to traffic on U. S. 99 provides four 10-foot traffic lanes.

Another Dangerous Grade Crossing Eliminated

By W. J. DEADY
Resident Engineer

SEPARATION of grades of the Southern Pacific Railroad and the Golden State Highway at Delano, thirty miles north of Bakersfield, has recently been completed by the State Division of Highways.

The project involves a complete realignment, 0.97 mile in length, of which 0.20 mile is within the city limits. The improvement provides concrete surfacing with sweeping curves and easy grades, in keeping with modern highway practice.

The old crossing at the south entrance to Delano had long been considered one of the most dangerous and undesirable railroad crossings on the San Joaquin Valley route. Its location at the throat of the city, together with the 400 foot radius curves on either side of the tracks, made it hazardous even for light traffic. Travel on this road is particularly heavy, due to its proximity to Los Angeles, the Kern County oil fields, and the numerous farms of the Wasco district. The traffic count on this road was 4000 cars daily in 1935, which more than justified the separation of grades.

The project was jointly financed from State Highway funds and Federal aid for the elimination of grade crossings. The city of Delano also participated, with a portion of its gas tax allotment.

FOUR TRAFFIC LANES

The new structure consists of two "U" type gravity abutments and wings with plate girder superstructure. A width of forty-six feet, face to face of abutments, provides for four ten-foot lanes of traffic and two three-foot sidewalks. Minimum vertical clearance is fifteen feet. The pavement of the realignment consists of Portland cement concrete 0.55 foot thick. It is forty feet wide through the major portion of the new line, narrowing down to twenty feet at the extreme ends to connect with the existing twenty foot pavements.

Slopes of the depressed portion are blanketed with four inches of slope paving, with parapet walls and dykes

(Continued on page 25)



Old "S" grade crossing had 400-foot radius curve approaches.

State Highway Officials to Convene in California

By C. H. PURCELL, State Highway Engineer

ONE-TENTH of the national income of the United States comes from the business created by automobiles rolling over highways.

This means that one-tenth of all pay rolls of all gross earnings, of all dividends, of all profits of all the industries in the United States spring from the automobile and its use on the American highways.

This single fact and its ramifications are cited to give Californians a thumbnail analysis of the importance of the guests that California will have within the State between December 7th and 10th of this year, 1936.

For these guests are the officials that control America's greatest publicly-owned utility—the automobile highway. The official name of the convention is the American Association of State Highway Officials, who administer 432,282 miles of State roads throughout this country upon which 25,000,000 automobiles are annually operated, buying gasoline, renting garage space, requiring steel, aluminum, leather, hair, wood and all manner of products from all manner of industries and types of business.

IN NATIONAL SPOTLIGHT

Seat of the convention will be San Francisco, one of America's foremost convention cities. Two features of this convention will receive the spotlight of national attention.

One of them will be the work of the United States Bureau of Roads and the Department of Agriculture, for this agency is the fountain head of highway construction in America.

The second feature of this highway meeting in San Francisco will be the opinions expressed by the national highway officials and authorities upon the unusual highway connections which are ending the isolation of this historic Pacific Coast city, which highways are known as the San Francisco-Oakland Bay and Golden Gate bridges.

To some extent the San Francisco convention of the American Association will be a laboratory of highway investigation. For in San Francisco the highway officials can put civic transportation into a test tube, so to speak, and examine it in the process of making. The San Francisco-Oakland Bay Bridge will have been in operation, we trust, for more than a month when the American highway officials come to California.

OLD AND NEW CONTRASTS

They will be able to note the changing reactions of the metropolitan San Francisco to the end of its isolation. Evidence of old inconveniences of boat travel should still be everywhere apparent, and evidences of new growth and development as a result of improved transportation should also be beginning to show signs of budding.

Californians are loyal to their highways and are often ones to boast about them and elevate them beyond their true comparative value. I fear that our California road boosters may receive some shocks, if our guests are frank and candid. Californians will learn that we are not quite in the first rank of highway construction, many of our roads being obsolete and overworked by traffic much greater than they were ever intended to bear.

But we do not fear these honest criticisms of these experts. For it will have a salutary effect. The State Division of Highways has never ceased telling the California Legislature, the Governor, and the people of the State, that our State is especially dependent upon highways and that we are not in California breaking any records for investments in good roads.

We expect, however, some commendation from our fellow highway builders for the methods and technique by which we build and main-

(Continued on page 23)

Toll Plaza Details at Business End of the Bay Bridge

IMPORTANT features of the great San Francisco-Oakland Bay Bridge are the Administration Building and Toll Plaza erected on the Key Route fill approximately 3500 feet east of the bridge end on the Oakland side.

It is here that all automobile and truck tolls will be collected and headquarters for the bridge patrol and administrative officers will be situated. Here also will be located the control board of the bridge's great electric system.

The administration building itself is three stories high including the basement. It is 185 feet long overall and 70½ feet at its greatest width.

With an exterior finish of terra cotta, the building is made entirely of concrete, steel, and aluminum.

BULLET-PROOF ROOM

It houses a garage, where tow cars and other facilities will be kept; a first-aid room; locker rooms for the bridge patrol and other employees; a drafting room and offices for the carrying on of the administrative work of the bridge. Also it will house a bullet-proof room where toll collections will be temporarily deposited.

On the wall opposite the desk sergeant a giant micarta board will be installed. On this board has been carved an exact reproduction of the entire bridge and its approaches. Tiny lamps will indicate the position of each light as it is on the bridge. This is the control board, and it is so arranged that the desk sergeant at one glance can tell whether the lights are operating efficiently on the giant structure or not.

When one of the lights on the bridge goes out, it means that its tiny understudy on the board also goes out. Also indicated on the board are the fog bells and aerial beacons.

Police telephones and fire boxes on the bridge are also connected to the office of the desk sergeant.

There will be twelve lanes for automobile traffic and four lanes for truck traffic.

Several methods of registering tolls and automobiles passing through the toll booths have been devised.



Administration Building and Toll Booths of San Francisco-Oakland Bay bridge are located on a spacious plaza at Oakland end.



Headquarters for Bridge Patrol, executive offices and a garage are housed in 3-story and basement Administration Building 185 feet long by 70½ feet wide, built entirely of concrete, steel and aluminum.



As sixteen lines of traffic pass under this canopy each toll payment will show on lighted indicator for driver's benefit.

When an automobile passes into the toll booth it will cross over an indicator that will register it per axle on a tape in the toll collector's machine. At the same time the collector will register on the machine an arbitrary number that will have been given to that particular type of car with that particular number of passengers. This arbitrary number will show in lights on a glass indicator above the booth, thus permitting an inspector to check up on the accuracy of the collector.

Meanwhile, for the benefit of the motorist, the amount of his toll will appear in lights on a sidewalk indicator outside the toll booth. Thus as accurate a check as possible will be kept of the number of passengers crossing in motor cars over the bridge.

SUMMER TRAFFIC COUNT SHOWS 10% INCREASE OVER 1935

By T. H. DENNIS
Maintenance Engineer

THE volume of traffic carried by the State highways steadily increases. This is shown in the annual summer count taken on Sunday and Monday, July 12th and 13th.

The July count of 1935 registered a gain of 15.3 per cent over the similar period of 1934. This exceptionally heavy increase was due in considerable measure to the unusual traffic attracted by the San Diego Exposition, as was noted in the last report.

This year we find the total traffic on the State highways has increased approximately 10 per cent over the heavy movement recorded in 1935 and has been confined to no one section of the State, nor has there been any unique circumstance or occasion that could be said to have had an exceptional influence on highway traffic.

The count was made in the regular manner, covering the sixteen-hour period from 6 a.m. to 10 p.m. each day, and segregating the traffic by hourly periods into the following classifications: California automobiles, foreign automobiles, light trucks, heavy trucks, trailers, buses and horse-drawn.

While some slight changes have been made in adding new stations or in relocating or discontinuing former stations, the comparative percentages in all cases have been drawn from stations identical for the 1935 and 1936 counts.

The comparisons for the various groupings are as follows:

Per Cent Gain or Loss for 1936 Count as Compared with 1935

	Sunday	Monday
All Routes	+ 7.58	+10.55
Main North and South Routes	+ 5.41	+ 9.75
Interstate Connections	+11.75	+ 9.88
Laterals Between Inland and Coast	+10.83	+14.94
Recreational Routes	+ 6.60	+ 7.61

The gain or loss of traffic volume for State Highway Routes 1 to 80, inclusive, which constitute the basis for the foregoing summary, is shown in the following tabulation:

Route	Termini	1936 Per cent gain or loss Sunday Gain	Loss	Monday Gain	Loss
1.	Sausalito-Oregon Line	6.72		19.38	
2.	Mexico Line-San Francisco	1.73		4.09	
3.	Sacramento-Oregon Line	15.50		11.74	
4.	Los Angeles-Sacramento	7.11		14.58	
5.	Santa Cruz-Jc. Rt. 65 near Mokelumne Hill	12.48		14.98	
6.	Napa-Sacramento via Winters	19.72		20.93	
7.	Crockett-Red Bluff	9.82		20.38	
8.	Ignacio-Cordelia via Napa	9.47		18.91	
9.	Rt. 2 near Montalvo-San Bernardine	13.63		16.18	
10.	Rt. 2 at San Lucas-Sequoia National Park	2.03		11.33	
11.	Rt. 75 near Antioch-Nevada Line via Placerville	13.12		6.20	
12.	San Diego-El Centro		0.15		1.81
13.	Rt. 4 at Salida-Rt. 23 at Sonora Jc.	3.44		11.02	
14.	Albany-Martinez	9.07		20.33	
15.	Rt. 1 near Calpella-Rt. 37 near Cisco	7.89		19.79	
16.	Hopland-Lakeport	3.96		14.26	
17.	Rt. 3 at Roseville-Rt. 15, Nevada City	5.22		12.39	
18.	Rt. 4 at Merced-Rt. 40 near Sequoia		2.39	12.10	
19.	Rt. 2 at Fullerton-Rt. 26 at Beaumont	10.14		11.09	
20.	Rt. 1 near Arcata-Rt. 83 at Park Boundary	18.15		15.91	
21.	Rt. 3 near Richvale-Rt. 29 near Chilcoot via Quincy	31.84		16.39	
22.	Rt. 56, Castroville-Rt. 29 via Hollister	16.19		16.14	
23.	Rt. 4 at Tunnel Sta.-Rt. 11, Alpine Jc.	10.37		15.54	
24.	Rt. 4 near Lodi-Nevada State Line	4.96		26.06	
25.	Rt. 37 at Colfax-Rt. 83 near Sattley		9.24		25.07
26.	Los Angeles-Mexico via San Bernardino	16.83		12.41	
27.	El Centro-Yuma	0.39		0.96	
28.	Redding-Nevada Line via Alturas	41.47		29.48	
29.	Peanut-Nevada Line near Purdy's	27.32		46.66	
31.	San Bernardino-Nevada State Line	12.81		12.94	
32.	Rt. 56, Watsonville-Rt. 4 near Califa	12.70		16.07	
33.	Rt. 56 near Cambria-Rt. 4 near Famosa	8.08		2.76	
34.	Rt. 4 at Galt-Rt. 23 at Pickett's Jc.	15.46		16.38	
35.	Rt. 1 at Alton-Rt. 20 at Douglas City	42.41			3.36
37.	Auburn-Truckee	6.46		16.18	
38.	Rt. 11 at Mays-Nevada Line via Truckee River	14.42		10.05	
39.	Rt. 38 at Tahoe City-Nevada State Line	10.98		12.00	
40.	Rt. 13 near Montezuma-Rt. 76 at Benton	5.78		13.82	
41.	Rt. 5 near Tracy-Kings River Canyon via Fresno	26.00		34.32	
42.	Redwood Park-Los Gatos	9.76		13.83	
43.	Rt. 60 at Newport Beach-Rt. 31 near Victorville		3.73	3.46	
44.	Boulder Creek-Redwood Park	7.27		4.74	
45.	Rt. 7, Willows-Rt. 3 near Biggs	16.19		6.95	
46.	Rt. 1 near Klamath-Rt. 3 near Cray	11.92		15.56	
47.	Rt. 7, Orland-Rt. 29 near Morgan	5.83		7.77	
48.	Rt. 1 N. of Cloverdale-Rt. 56 near Albion		11.27		4.01
49.	Napa-Rt. 15 near Sweet Hollow Summit	10.83		9.62	
50.	Sacramento-Rt. 15 near Wilbur Springs	7.13		7.08	
51.	Rt. 8 at Schellville-Sebastopol	14.87		2.38	
52.	Alta-Tiburon	7.20		17.49	
53.	Rt. 7 at Fairfield-Rt. 4 at Lodi via Rio Vista	6.54		9.50	
54.	Rt. 11 at Perkins-Rt. 65 at Central House	13.25		33.77	
55.	Rt. 5 near Glenwood-San Francisco	20.79		20.00	
56.	Rt. 2 at Las Cruces-Rt. 1 near Fernbridge	10.32		11.62	
57.	Rt. 2 near Santa Marie-Rt. 23 near Freeman via Bakersfield		2.98	13.43	
58.	Rt. 2 near Santa Margarita-Ariz. Line near Topock via Mojave and Barstow	24.32		20.26	
59.	Rt. 4 at Baileys-Rt. 43 at Lake Arrowhead	3.06		6.80	
60.	Rt. 2 at Serra-Rt. 2 at El Rio	5.20		1.44	
61.	Rt. 4 S. of Glendale-Rt. 59 near Phelan	1.25		1.29	
62.	Rt. 171 at Nertham-Rt. 61 near Crystal Lake	3.63		4.45	
63.	Big Pine-Nevada State Line		19.42		16.56
64.	Rt. 2 at San Juan Capistrano-Blythe		6.98		3.84
65.	Rt. 18 near Mariposa-Auburn	30.60		33.71	
66.	Rt. 5 near Mossdale-Rt. 13 near Oakdale	6.79		2.33	
67.	Pajaro River-Rt. 2 near San Benito River Bridge		10.60		25.64
68.	San Jose-San Francisco	10.69		13.21	
69.	Rt. 5 at Warm Springs-Rt. 1, San Rafael	0.07		16.44	
70.	Ukiah-Talmage	10.00			3.37
71.	Crescent City-Oregon Line	10.79		19.94	
72.	Weed-Oregon Line	39.01		38.06	
73.	Rt. 29 near Johnstenville-Oregon Line	29.82		47.03	
74.	Napa Wye-Cordelia via Vallejo and Benicia	5.65		8.27	
75.	Oakland-Jc. Rt. 65 at Altaville	8.24		18.48	
76.	Rt. 125 at Shaw Ave.-Nevada State Line near Benton		18.85		14.34
77.	San Diego-Los Angeles via Pomona	2.40			0.23
78.	Rt. 12 near Oceanside-Rt. 19 near March Field	1.64			5.00
79.	Rt. 2, Ventura-Rt. 4 at Castaic	13.27		11.63	
80.	Rt. 51, Rincon Creek-Rt. 2 near Zaca		0.96	5.94	

COMPLETION OF THE CALWA OVERPASS

(Continued from page 9)

control of deck grades, prevented cracking, and saved time and lumber in erection.

High early strength cement was used in pouring the decks in order to make possible quicker stripping times and provide maximum use of the steel falsework trusses. A giant duraluminum adjustable screed float forty-two feet long, which could easily be handled by two men on each end, made deck finishing easier, faster, and more accurate. All the concrete for the job was batched at a central mixing plant in Fresno and hauled to the site in transit mix trucks.

As a controlling factor in obtaining a high strength of concrete accurate control in the mixing of water was maintained with the use of an electrical sand moisture determinator at the transit mix plant.

The construction of the Calwa Overpass gave employment to many local residents. The cost of this project will total approximately $216,000.

'Only Golden Rule Will End Death Toll on Highways'

—Gov. Frank F. Merriam

A summary of the California Vehicle Code, 1935, compiled by the Department of Motor Vehicles, is off the press and is being distributed by Director Ray Ingels.

Only matter directly applicable to operators of motor vehicles has been selected from the statutes in preparing the summary. This was done in order to simplify the laws for drivers and, consequently, educate operators to the necessity of good driving for their own safety and the protection of the public.

In a foreword, Governor Frank F. Merriam explains the reason for the publication of the booklet in these words:

"Death can be ruled off the highways only through one process—the individual effort of each operator of a motor vehicle!

"Recognition of this fact brings us to the realization that only one rule can be laid down to eliminate the appalling toll of Death rampant on the highways, an adaptation of the Golden Rule to operation of motor vehicles—drive as you would have others drive.

"California, through its Department of Motor Vehicles and publication of this book, desires to help its citizens to drive as they would have others drive to the end that Death and Injury be driven from the highways."

INVENTS RAIN ALARM

Maintenance Superintendent C. T. Warren of District VII tells a story about one of his crew foremen who has invented an ingenious device to roust himself out of bed when a storm of rain blows up and the highways become unexpectedly slippery and dangerous. He has attached to the eave of his home an empty coffee can so balanced that when rain water pours into it the can falls upon two contact points completing an electric circuit that rings a bell in his bedroom. When this occurs, the foreman gets up, dresses and goes out into the wet night to patrol his sections of road.

CITIES MUST SUBMIT BUDGETS FOR GAS TAX EXPENDITURES

(Continued from page 1)

While the amendment affirmed the provisions of the original act denying expenditure of the funds for any purpose not of direct benefit to vehicular traffic, the apportionment for streets of major importance is contradistinguished by permissive expenditure upon city streets other than State Highways, and by direct payment of the money to the cities by the Division of Highways in quarterly apportionments, upon the warrant of budgets of proposed expenditures submitted by the cities annually to the Department for approval.

An important qualification of such budgets is the expenditure upon streets commanding prominence as major traffic arterials. This condition precludes indiscriminate expenditures upon streets which are restrictive of general traffic service. Other conditions of the law require the proposals to be sound both economically and in engineering judgment, with a full appreciation of traffic demands, under penalty of disapproval by the Department.

Under section 203 of the code which provides the allocation for State highways, the Division of Highways is obliged to assure the expenditure of funds apportioned under this section for the fullest benefit of State highway routes, with the further discretionary privilege of delegating the obligation to cities competently equipped to conduct such expenditures.

This privilege was endorsed by the Director of Public Works and was immediately pronounced upon inception of the law as the Department's administrative policy. No detraction has been made from this policy, and the cities enjoy a free choice in the selection and performance of work to be done within the limitations prescribed by law of which adequate provision for maintenance of State highway routes takes precedence and improvements, logically, are given second consideration.

STATE FUNDS ADVANCED

The funds allocated for State highways under section 203 and previously under Chapter 767, are paid to the cities in reimbursement for delegated work already performed and immediately upon billing of the Department by the cities.

In the majority of cases, particularly in the case of improvement projects, this procedure requires the Department to advance money from the cash balance of the State Highway Fund before the gas tax has been collected and actually apportioned to this fund.

Under the provisions of section 198 the revenue for streets of major importance is disbursed when and with the quarterly apportionments made by the State Controller.

Of the apportionment for State highways, $2,685,595.61 has been actually paid to and expended by the cities during the past fiscal year, while the actual disbursement of ¼ cent funds for streets of major importance to the cities for the same period was $1,994,757.79. The remaining $572,666.17 of the latter apportionment includes amounts being accumulated upon the authorization of certain cities for expenditure at a future date, and the apportionments to cities which have not submitted a budget of proposed expenditures.

CITIES IGNORE LAW

Although the law is quite explicit on the latter point and operates to restrain the Department from paying money to a city until a budget has been submitted and approved, knowledge of this clause among the cities does not appear to be quite general. Many inquiries are received from cities which have not submitted budgets asking the Department why the apportionments have not been paid.

In the accompanying tabulation, the respective annual apportionment for the fiscal year ending June 30, 1936, is given as accruing to each city.

The tabulation includes the amount accrued under section 203 for expenditure upon designated State highway routes, and the amount accrued under section 194 for expenditure upon streets of major importance other than State highway routes.

(Continued on page 16)

GASOLINE TAX APPORTIONMENTS TO THE

DISTRICT I

County	City	State Highways (Section 203)	Streets of Major Importance (Section 194)
Del Norte	Crescent City	$1,343 45	$1,028 98
Total	Del Norte County	$1,343 45	$1,028 98
Humboldt	Arcata	$1,334 84	$1,022 40
	Blue Lake	433 50	332 02
	Eureka	12,303 47	9,423 59
	Ferndale	694 38	531 85
	Fortuna	967 74	741 23
	Trinidad	83 57	64 01
Total	Humboldt County	$15,817 50	$12,115 10
Lake	Lakeport	$1,029 46	$788 49
Total	Lake County	$1,029 46	$788 49
Mendocino	Fort Bragg	$2,360 40	$1,807 90
	Point Arena	300 70	230 32
	Ukiah	2,440 07	1,868 92
	Willits	1,112 27	851 92
Total	Mendocino County	$6,213 44	$4,759 06
	Total District I	$24,403 85	$18,691 63

DISTRICT II

County	City	State Highways (Section 203)	Streets of Major Importance (Section 194)
Lassen	Susanville	$1,069 70	$812 42
Total	Lassen County	$1,060 70	$812 42
Modoc	Alturas	$1,826 16	$1,398 71
Total	Modoc County	$1,826 16	$1,398 71
Plumas	No Incorporated Cities		
Shasta	Redding	$3,271 12	$2,505 45
Total	Shasta County	$3,271 12	$2,505 45
Siskiyou	Dorris	$595 18	$455 86
	Dunsmuir	2,038 59	1,561 42
	Etna	296 02	226 74
	Fort Jones	235 89	180 67
	Montague	396 01	303 31
	Mt. Shasta	788 09	603 62
	Yreka	1,705 48	1,316 75
Total	Siskiyou County	$6,055 26	$4,648 37
Tehama	Corning	$1,075 55	$823 79
	Red Bluff	2,747 03	2,104 04
	Tehama	148 40	113 66
Total	Tehama County	$3,970 98	$3,041 49
	Total District II	$16,184 22	$12,406 44

DISTRICT III

County	City	State Highways (Section 203)	Streets of Major Importance (Section 194)
Butte	Biggs	$361 64	$276 99
	Chico	6,218 13	4,762 65
	Gridley	1,516 05	1,161 19
	Oroville	2,888 42	2,212 33
Total	Butte County	$10,984 24	$8,413 16
Colusa	Colusa	$1,652 75	$1,265 89
	Williams	664 69	509 10
Total	Colusa County	$2,317 44	$1,774 99
El Dorado	Placerville	$1,813 65	$1,389 13
Total	El Dorado County	$1,813 65	$1,389 13
Glenn	Orland	$933 38	$714 91
	Willows	1,580 89	1,210 85
Total	Glenn County	$2,514 27	$1,925 76

DISTRICT III—Continued

County	City	State Highways (Section 203)	Streets of Major Importance (Section 194)
Nevada	Grass Valley	$2,981 35	$2,283 50
	Nevada City	1,328 61	1,017 62
Total	Nevada County	$4,309 96	$3,301 12
Placer	Auburn	$2,078 44	$1,591 94
	Colfax	712 34	545 60
	Lincoln	1,635 57	1,252 73
	Rocklin	565 49	433 13
	Roseville	5,018 40	3,843 74
Total	Placer County	$10,010 24	$7,667 14
Sacramento	North Sacramento	$1,637 92	$1,254 53
	Sacramento	73,225 60	56,085 65
Total	Sacto Co. (Portion)	$74,863 52	$57,340 18
Sierra	Loyalton	$653 76	$500 73
Total	Sierra County	$653 76	$500 73
Sutter	Yuba City	$2,815 77	$2,156 68
Total	Sutter County	$2,815 77	$2,156 68
Yolo	Davis	$970 88	$743 63
	Winters	699 84	536 02
	Woodland	4,344 87	3,331 64
Total	Yolo County	$6,015 59	$4,611 29
Yuba	Marysville	$4,501 33	$3,447 70
	Wheatland	374 12	286 55
Total	Yuba County	$4,875 45	$3,734 25
	Total District III	$121,173 89	$92,814 43

DISTRICT IV

County	City	State Highways (Section 203)	Streets of Major Importance (Section 194)
Alameda	Alameda	$27,363 33	$20,958 38
	Albany	6,693 01	5,126 38
	Berkeley	64,133 14	49,121 47
	Emeryville	1,824 59	1,397 51
	Hayward	4,319 34	3,308 31
	Livermore	2,436 17	1,865 93
	Oakland	221,873 97	169,939 83
	Piedmont	7,289 76	5,583 44
	Pleasanton	966 18	740 03
	San Leandro	8,947 18	6,852 91
Total	Alameda County	$345,846 67	$264,894 19
Contra Costa	Antioch	$3,348 86	$2,696 90
	Concord	878 70	673 03
	El Cerrito	3,022 75	2,315 22
	Hercules	306 18	234 51
	Martinez	5,274 59	4,073 46
	Pinole	610 02	467 23
	Pittsburg	7,506 12	5,749 16
	Richmond	15,694 10	12,020 58
	Walnut Creek	792 01	606 62
Total	Contra Costa County	$37,433 33	$28,836 71
Marin	Belvedere	$390 53	$299 12
	Corte Madera	802 16	614 40
	Fairfax	2,284 64	1,749 88
	Larkspur	969 32	742 43
	Mill Valley	3,252 39	2,491 10
	Ross	1,058 35	810 63
	San Anselmo	3,631 98	2,781 84
	San Rafael	6,265 78	4,799 14
	Sausalito	2,864 20	2,193 77
Total	Marin County	$21,519 35	$16,482 31

ES FOR FISCAL YEAR ENDING JUNE 30, 1936

DISTRICT IV—Continued

County	City	State Highways (Section 203)	Streets of Major Importance (Section 194)
Napa	Calistoga	$781 07	$598 25
	Napa	5,027 76	3,850 91
	St Helena	1,235 66	946 42
Total	Napa County	$7,044 49	$5,395 58
San Francisco	San Francisco	$495,508 08	$379,524 29
Total	San Francisco Co.	$495,508 08	$379,524 29
San Mateo	Atherton	$1,034 14	$792 08
	Bay Shore	897 46	687 39
	Belmont	777 56	597 65
	Burlingame	10,364 83	7,938 73
	Daly City	6,479 55	5,046 21
	Hillsborough	1,477 01	1,131 29
	Lawndale	288 22	220 75
	Menlo Park	1,760 53	1,348 44
	Redwood City	6,999 98	5,361 49
	San Bruno	2,819 68	2,159 68
	San Carlos	884 18	677 22
	San Mateo	10,507 93	8,050 01
	South San Francisco	4,837 18	3,704 94
Total	San Mateo County	$49,128 25	$37,715 88
Santa Clara	Alviso	$297 58	$227 93
	Gilroy	2,735 32	2,095 06
	Los Gatos	2,474 45	1,895 25
	Morgan Hill	709 22	543 21
	Mountain View	2,583 79	1,979 00
	Palo Alto	10,695 22	8,199 28
	San Jose	45,151 80	34,611 58
	Santa Clara	4,922 33	3,770 16
	Sunnyvale	2,416 63	1,850 97
	Willow Glen	3,254 73	2,492 89
Total	Santa Clara County	$75,241 07	$57,665 33
Santa Cruz	Santa Cruz	$11,243 56	$8,611 77
	Watsonville	6,695 12	5,169 45
Total	Santa Cruz County	$17,938 68	$13,781 22
Sonoma	Cloverdale	$592 82	$454 06
	Healdsburg	1,793 35	1,373 58
	Petaluma	6,439 96	4,932 55
	Santa Rosa	8,307 49	6,362 95
	Sebastopol	1,376 25	1,054 11
	Sonoma	765 46	586 29
Total	Sonoma County	$19,275 33	$14,763 54
Total	District IV	$1,068,935 25	$819,059 05

DISTRICT V

County	City	State Highways (Section 203)	Streets of Major Importance (Section 194)
Monterey	Carmel	$1,765 22	$1,352 03
	King City	1,158 33	887 20
	Monterey	7,139 79	5,468 58
	Pacific Grove	4,341 20	3,325 05
	Salinas	8,136 51	6,260 06
	Soledad	463 96	355 36
Total	Monterey County	$23,005 01	$17,648 28
San Benito	Hollister	$2,934 50	$2,247 62
	San Juan Bautista	602 98	461 84
Total	San Benito County	$3,537 48	$2,709 46
San Luis Obispo	Arroyo Grande	$696 71	$533 63
	Paso Robles	2,009 70	1,539 29
	San Luis Obispo	6,464 17	4,951 10
Total	San Luis Obispo Co.	$9,170 58	$7,024 02

DISTRICT V—Continued

County	City	State Highways (Section 203)	Streets of Major Importance (Section 194)
Santa Barbara	Lompoc	$2,222 16	$1,702 01
	Santa Barbara	26,254 21	20,108 88
	Santa Maria	5,512 03	4,221 83
Total	Santa Barbara Co.	$33,988 40	$26,032 72
Total	District V	$69,701 47	$53,414 48

DISTRICT VI

County	City	State Highways (Section 203)	Streets of Major Importance (Section 194)
Fresno	Coalinga	$2,226 83	$1,705 59
	Clovis	1,027 89	787 30
	Firebaugh	395 23	302 72
	Fowler	914 64	700 55
	Fresno	41,025 46	31,424 71
	Kingsburg	1,032 59	790 89
	Parlier	440 52	337 41
	Reedley	2,022 20	1,548 86
	Sanger	2,317 44	1,774 99
	San Joaquin	127 32	97 52
	Selma	2,379 93	1,822 86
Total	Fresno County	$53,910 05	$41,293 40
Kern	Bakersfield	$20,319 62	$15,563 39
	Delano	2,055 79	1,574 59
	Maricopa	836 52	640 72
	Taft	2,688 46	2,059 17
	Tehachapi	574 87	440 31
Total	Kern County	$26,475 26	$20,278 18
Kings	Corcoran	$1,380 94	$1,057 71
	Hanford	5,489 37	4,204 47
	Lemoore	1,092 72	836 94
Total	Kings County	$7,963 03	$6,099 12
Madera	Chowchilla	$661 56	$506 71
	Madera	3,643 72	2,790 83
Total	Madera County	$4,305 28	$3,297 54
Tulare	Dinuba	$2,318 23	$1,775 61
	Exeter	2,097 18	1,606 29
	Lindsay	3,029 00	2,320 00
	Porterville	4,142 03	3,172 50
	Tulare	4,848 13	3,713 32
	Visalia	5,672 92	4,345 06
Total	Tulare County	$22,107 49	$16,932 78
Total	District VI	$114,761 11	$87,901 02

DISTRICT VII

County	City	State Highways (Section 203)	Streets of Major Importance (Section 194)
Los Angeles	Alhambra	$23,019 78	$17,631 53
	Arcadia	4,074 07	3,120 45
	Avalon	1,481 71	1,134 88
	Azusa	3,755 40	2,876 37
	Bell	6,157 98	4,716 57
	Beverly Hills	13,613 32	10,426 85
	Burbank	13,014 24	9,967 99
	Compton	9,775 91	7,487 66
	Covina	2,166 69	1,659 54
	Culver City	4,427 91	3,391 47
	Claremont	2,123 74	1,626 63
	El Monte	2,717 37	2,081 31
	El Segundo	2,736 10	2,095 66
	Gardena	5,501 87	4,214 05
	Glendale	49,001 40	37,531 62
	Glendora	2,156 54	1,651 76
	Hawthorne	5,151 96	3,946 04
	Hermosa Beach	3,746 03	2,869 20
	Huntington Park	19,207 37	14,711 49
	Inglewood	16,377 62	12,815 04

(Continued on page 18)

GASOLINE TAX APPORTIONMENTS TO CITIES

(Continued from page 17)

DISTRICT VII—Continued

County	City	State Highways (Section 203)	Streets of Major Importance (Section 194)
Los Angeles—Continued	La Verne	2,233 87	1,710 99
	Long Beach	111,248 17	85,280 70
	Los Angeles	968,940 39	742,170 24
	Lynwood	5,719 80	4,380 97
	Manhattan Beach	1,477 01	1,131 29
	Maywood	5,306 60	4,064 49
	Monrovia	8,505 88	6,514 90
	Montebello	4,294 35	3,289 17
	Monterey Park	5,003 55	3,832 36
	Pasadena	59,568 85	45,658 20
	Pomona	16,249 44	12,445 93
	Redondo Beach	7,300 69	5,591 83
	San Fernando	5,910 38	4,526 93
	San Gabriel	5,687 39	4,366 61
	San Marino	2,913 40	2,231 46
	Santa Monica	29,013 74	22,222 48
	Sierra Madre	2,772 81	2,123 77
	Signal Hill	2,290 11	1,754 06
	South Gate	15,334 03	11,744 79
	South Pasadena	10,724 13	8,213 93
	Torrance	6,615 15	5,284 91
	Vernon	991 19	759 18
	West Covina	690 48	549 79
	Whittier	11,577 07	8,867 22
	Total Los Angeles County	$1,480,575 49	$1,134,672 31
Orange	Anaheim	$8,598 69	$6,588 50
	Brea	1,901 91	1,456 73
	Fullerton	8,482 46	6,496 96
	Huntington Beach	2,882 16	2,207 53
	Laguna Beach	1,547 30	1,185 13
	La Habra	1,775 38	1,359 82
	Newport Beach	1,720 71	1,317 95
	Orange	6,300 13	4,825 45
	Placentia	1,254 39	960 78
	San Clemente	520 98	399 03
	Santa Ana	23,683 70	18,140 04
	Seal Beach	902 91	691 57
	Tustin	723 28	553 98
	Total Orange County	$60,294 00	$46,183 47
Ventura	Fillmore	$2,259 65	$1,730 73
	Ojai	1,146 61	878 23
	Oxnard	4,909 04	3,759 98
	Santa Paula	5,820 56	4,458 13
	Ventura	9,062 79	6,941 46
	Total Ventura County	$23,198 65	$17,768 53
	Total District VII	$1,564,068 14	$1,198,624 31

DISTRICT VIII

County	City	State Highways (Section 203)	Streets of Major Importance (Section 194)
Riverside	Banning	$2,149 51	$1,646 38
	Beaumont	1,040 39	796 87
	Corona	5,481 58	4,198 50
	Elsinore	1,054 45	807 63
	Hemet	1,745 69	1,337 08
	Perris	595 95	456 46
	Riverside	23,194 76	17,765 55
	San Jacinto	1,051 32	805 23
	Total Riverside County	$36,313 65	$27,813 70
San Bernardino	Chino	$2,435 39	$1,865 33
	Colton	6,259 52	4,794 35
	Needles	2,455 69	1,880 89
	Ontario	10,609 32	8,125 99
	Redlands	11,073 28	8,481 35
	Rialto	1,282 52	982 32
	San Bernardino	30,002 98	23,149 77

DISTRICT VIII—Continued

County	City	State Highways (Section 203)	Streets of Major Importance (Section 194)
San Bernardino—Continued	Upland	3,681 19	2,819 53
	Total San Bernardino Co.	$67,799 89	$52,099 53
	Total District VIII	$104,113 54	$79,913 23

DISTRICT IX

Inyo	Bishop	$905 26	$693 37
	Total Inyo County	$905 26	693 37
Mono	No Incorporated Cities		

DISTRICT X

Alpine	No Incorporated Cities		
Amador	Amador City	$133 56	$102 31
	Jackson	1,566 06	1,199 49
	Plymouth	267 91	205 20
	Sutter Creek	791 22	606 01
	Total Amador County	$2,758 75	$2,113 01
Calaveras	Angels Camp	$714 69	$547 40
	Total Calaveras County	$714 69	$547 40
Mariposa	Hornitos	$48 42	$37 09
	Total Mariposa County	$48 42	$37 09
Merced	Atwater	$716 25	$548 59
	Dos Palos	556 91	556 37
	Gustine	793 57	607 82
	Livingston	627 20	480 39
	Los Banos	1,464 51	1,121 71
	Merced	5,519 06	4,227 22
	Total Merced County	$9,677 50	$7,542 10
Sacramento	Isleton	$2,121 09	$1,738 51
	Total Sacto Co. (Portion)	$2,121 09	$1,738 51
San Joaquin	Lodi	$5,301 93	$4,060 90
	Manteca	1,260 64	965 56
	Stockton	37,462 61	28,693 73
	Tracy	2,990 73	2,290 69
	Total San Joaquin County	$47,015 91	$36,010 88
Solano	Benicia	$2,275 26	$1,742 69
	Dixon	781 06	598 24
	Fairfield	883 40	676 62
	Rio Vista	1,022 43	783 10
	Suisun	706 87	541 42
	Vacaville	1,215 35	930 87
	Vallejo	11,446 90	8,800 31
	Total Solano County	$18,331 27	$14,073 25
Stanislaus	Ceres	$766 23	$586 88
	Modesto	10,822 39	8,291 70
	Newman	991 19	759 18
	Oakdale	1,649 63	1,263 50
	Patterson	706 89	541 43
	Riverbank	627 20	480 39
	Turlock	3,339 86	2,558 09
	Total Stanislaus County	$18,903 39	$14,481 17
Tuolumne	Sonora	$1,779 28	$1,362 80
	Total Tuolumne County	$1,779 28	$1,362 80
	Total District X	$101,350 30	$77,906 21



California Highway Commission in session with three recently appointed members present. Left to right: Julien D. Roussel, secretary; William T. Hart, Paul G. Jasper, Harry A. Hopkins, chairman; H. R. Judah and Philip A. Stanton.

DISTRICT XI

County	City	State Highways (Section 203)	Streets of Major Importance (Section 194)
Imperial	Brawley	$8,153 62	$6,245 10
	Calexico	4,919 98	3,768 36
	Calipatria	1,213 79	929 67
	El Centro	6,587 57	5,045 62
	Holtville	1,373 13	1,051 72
	Imperial	1,517 62	1,162 39
	Westmoreland	1,152 87	883 02
Total	Imperial County	$24,918 58	$19,085 88
Riverside	Blythe	$796 69	$610 21
	Indio	2,031 57	1,556 04
Total	Riverside County	$2,828 26	$2,166 25
San Diego	Chula Vista	$3,021 96	$2,314 61
	Coronado	4,237 33	3,245 49
	El Cajon	820 13	628 16
	Escondido	2,672 06	2,046 60
	La Mesa	1,962 84	1,503 40
	National City	5,702 61	4,367 80
	Oceanside	2,743 60	2,102 24
	San Diego	115,596 71	88,539 36
Total	San Diego County	$136,757 24	$104,747 66
	Total District XI	$164,504 08	$125,999 79

A careful motorist is one who avoids not only the wet spots in the roads but the wet spots along it.

Highway Board Completed

By JULIEN D. ROUSSEL, Secretary

For the first time in twenty months a full membership was present at the meeting of the California Highway Commission in Long Beach on July 10th.

An illness of almost two years' duration had prevented Commissioner Philip A. Stanton from attending sessions and during that period there were several changes in the personnel of the commission.

"We have missed your wise counsel and guidance and are happy you are back with us again," Chairman Harry A Hopkins told Mr. Stanton in opening the meeting.

When Mr. Stanton took his seat he found a huge floral piece standing behind his chair. It was sent by the Los Angeles Chamber of Commerce, of which Mr. Stanton was one of the founders.

NEW APPOINTEE INTRODUCED

Attending were Commissioners Hopkins, Stanton, H. R. Judah, Paul G. Jasper and William T. Hart. It was Mr. Hart's first meeting, he having been appointed by Governor Frank F. Merriam to succeed the late Charles D. Hamilton of Banning.

(Continued on page 23)

RELOCATION OF U. S. 40 SOUTH OF VACAVILLE NEARING COMPLETION

By C. J. TEMBY, District Office Engineer

THE GRADING and paving with asphaltic concrete of the relocated section of State Highway between 3.7 miles north of Fairfield and 0.6 mile south of Vacaville is making satisfactory progress and will be finished this month.

This project, commonly referred to as the Orchard Line Change, improves a heavy traffic route, U. S. 40, between Sacramento and the Bay region. Its completion will eliminate a section of existing road composed of poor alignment and grades. The curvature on the present road totals approximately 866 degrees, compared with the curvature on the proposed alignment of 114 degrees, making a reduction of 752 degrees or more than two complete circles.

GRADES AND CURVES REDUCED

The maximum grade of the existing road was approximately 7 per cent as compared to the maximum on the proposed project of 5 per cent.

In addition to the reduction in curvature and grades, the new project will effect a saving of approximately 3500 feet or nearly three-quarters of a mile in distance. The minimum radius curve will be 3800 feet, while the minimum on the old road is 300 feet.

The new road is graded to a standard 36-foot roadbed and is being paved with asphaltic concrete 20 feet wide by six-tenths of a foot thick at the center, increasing to 75 hundredths thick in the outer 2 feet at the edge.

The earthwork on this project was through adverse soil, chiefly adobe, having a high shrinkage value, which made it necessary to provide a subgrade treatment of selected material to form a cushion between the native soils and the pavement. For this purpose, a selected material blanket, approximately 1 foot in thickness underneath the pavement and extending for the full width of the roadbed, was constructed.

The selected material was obtained from local source, a hill about 0.5 mile north of the town of Vacaville. This section required approximately 43,000 cubic yards of imported borrow. The grading required about 97,000 cubic yards of unclassified roadway excavation. The paving will require approximately 18,800 tons of asphalt concrete.

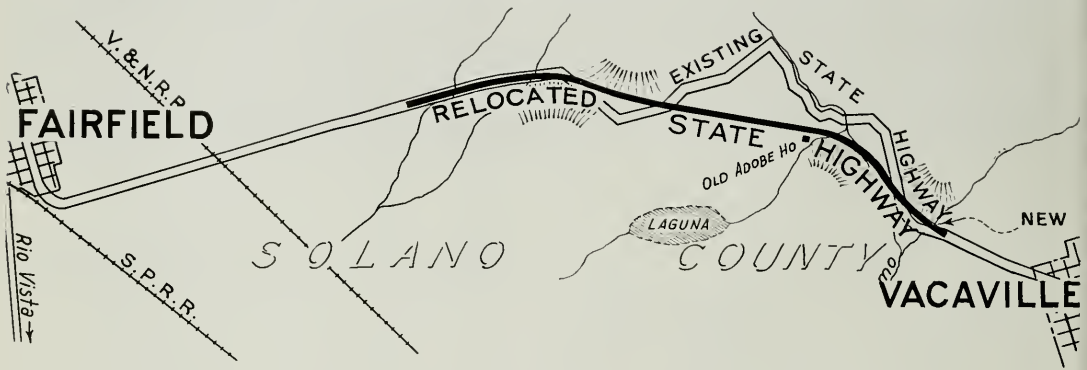
In addition to the grading and paving it was necessary to construct a new bridge across Alamo Creek, about 0.6 mile south of Vacaville, or at the northerly end of the project. This new bridge consists of a reinforced concrete structure on steel piles.

The completion of this road on new alignment and over the new bridge, requires the removal of the existing old bridge, which was quite a landmark to the public using the highway in this vicinity.

The construction of this highway will represent an expenditure of about $191,700 and is being financed from State highway funds and Federal funds under the control of the U. S. Bureau of Public Roads.

The contractor has established his paving plant on a railroad siding near the easterly boundaries of Vacaville. At this plant, a 3000 pound mixer is used and the pavement hauled by a fleet of trucks to the site of the work.

The contract progress to date has been satisfactory. It is expected that at the present rate all paving will be completed this month and the balance of the miscellaneous work on the road should be completed within about two week thereafter.



Map showing "Orchard Line Change," the relocated section of highway between Fairfield and Vacaville compared with existing crooked route.

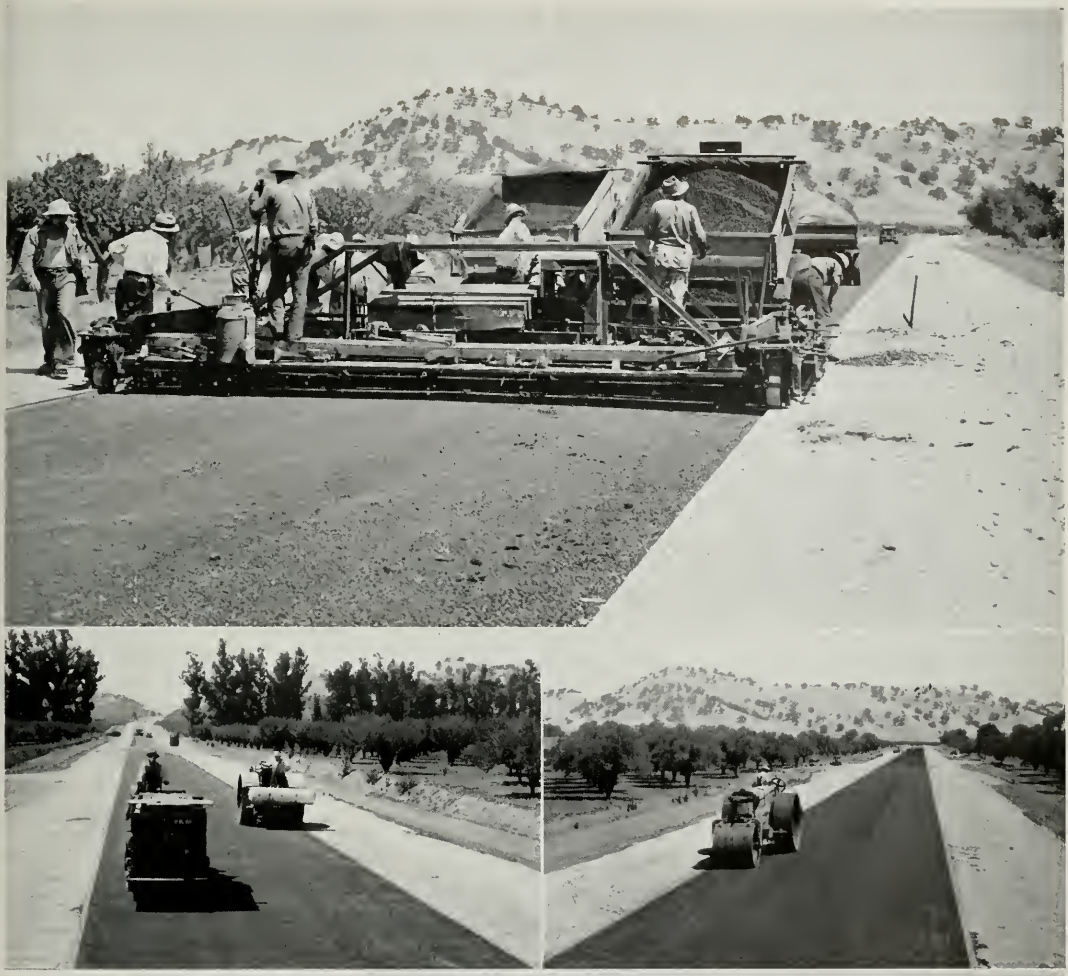
They say a Scotchman from Aberdeen is putting off buying an atlas until world affairs look a little more settled.

Mrs. Smythe-Browne was making the final arrangements for her elaborate reception.

"Bridget," she said to her old servant, "for the first thirty minutes after six o'clock I want you to stand at the drawing-room door and call the guests' names as they arrive."

Bridget's face lit up.

"Very well, ma'am," she replied. "I've been wantin' to do that to some of your friends for years."





Busy scenes on the Fairfield-Vacaville relocation of U. S. 40 showing equipment placing 20-foot asphaltic concrete pavement. At top, trucks dumping into spreader boxes and mechanical finishing machine in operation. Center, equipment rolling finishing course. At bottom, close-up of spreader box finishing machine.

In the Field With the Old Timers

COMES now an applicant for membership in the Old Timers' Club of the State Division of Highways who is an old timer in truth.

He is T. A. Bedford of Sacramento headquarters of the Division of Highways and he becomes head man of the club. His credentials, an identification card issued by the original California Highway Commission, show that he was appointed Division Engineer attached to Division 11, Redding, on December 9, 1911.

With the exception of ten months when he was in Cuba in 1928–29, Mr. Bedford has been continuously with the State in highway work since the date of his first appointment.

Cowpuncher in Texas, railroad man in the Lone Star State, Mexico, California and Oklahoma, a county surveyor in Texas and road builder in California, Mr. Bedford has had a varied experience. Born in Texas, March 9, 1870, he was reared on a cattle ranch there. His first engineering job was as head chainman with a survey party in Texas in the spring of 1886. From 1895 to 1901 he was county surveyor of Knox County, Texas. For eight years from 1901 he was chief of party and division engineer of the Kansas City, Mexico and Orient Railroad in Oklahoma, Texas and Mexico.

Mr. Bedford was riding range in Texas when a survey party of the Kansas City, Mexico and Orient Railroad stopped at the ranch where he was employed. He and the chief of party became friends and the latter one day asked him:



T. A. BEDFORD

"How would you like to become an engineer?"

"I don't know anything about the work," Bedford replied.

"Well," said the chief of party, "if you can punch cattle you can punch a track laying crew for me in Mexico."

And so Bedford quit the range and signed up, and has been engineering ever since.

From 1908 to 1911, Mr. Bedford was deputy highway engineer for the San Diego County Highway Commission. Like a number of other men who attained responsible positions with the California Highway Commission, Mr. Bedford met in San Diego Austin B. Fletcher, who was to become State Highway Engineer in 1911 and later the first director of the State Department of Public Works. He came into State service with Mr. Fletcher.

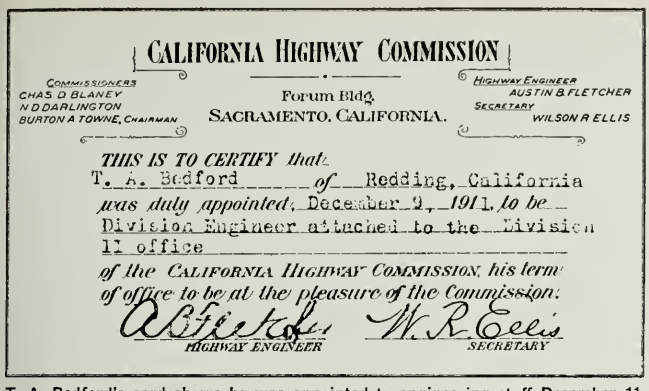
Mr. Bedford's first assignment under Mr. Fletcher was as Division Engineer at Redding. He spent two years there surveying and locating the Pacific Highway from Redding to the Oregon line, the laterals from Redding to Alturas, from Red Bluff to Susanville and the Trinity lateral from Redding to the coast.

Of those years Mr. Bedford relates:

"In the early days of State highway work, especially in Division II,



Tough reconnaissance work on Old Oregon Trail over Scott Mountain in 1912. T. A. Bedford with horse in center foreground.



CALIFORNIA HIGHWAY COMMISSION

COMMISSIONERS
CHAS. D. BLANEY
N. D. DARLINGTON
BURTON A. TOWNE, CHAIRMAN

Forum Bldg.
SACRAMENTO, CALIFORNIA.

HIGHWAY ENGINEER
AUSTIN B. FLETCHER
SECRETARY
WILSON R. ELLIS

THIS IS TO CERTIFY that
T. A. Bedford of Redding, California
was duly appointed, December 9, 1911, to be
Division Engineer attached to the Division
II office
of the CALIFORNIA HIGHWAY COMMISSION, his term
of office to be at the pleasure of the Commission.

HIGHWAY ENGINEER — SECRETARY

T. A. Bedford's card shows he was appointed to engineering staff December 11, 1911, making him head man in Old Timers' Club to date.

which embraced the most northern part of the State, a great deal of difficult and hazardous reconnaissance work was necessary.

"It required a great deal of energy and no small amount of good luck to complete a survey trip sometimes.

"Practically all of my reconnaissance trips were made alone. Fewer people got into less trouble that way. I had several close calls.

"In 1912 a very fine young horse was bought up in Modoc County for my use. He was six years old, a dark gray, tall, trim and rather wild. He tried to unload me more than once but didn't succeed. His energy was unbounded and he could do 45 miles over mountain trails in one day. Old Flip, that was his name, and very appropriate, died only last year at the age of 29, his hair white with age, after 23 years in the service of the State. He was, however, practically retired, on a pension I guess, during the last two years of his life.

"Most of the reconnaissance had to be made on foot. Many people around Redding thought that the Redding-Alturas lateral should follow the Pit River Canyon on a "water grade," whatever that is. Roscoe J. Anderson, an attorney at Redding, insisted on seeing that route. Roscoe did well but when we reached the Big Bend country, he came so near the end of his career on one of the bluffs overhanging the Pit that when we got on level ground we headed for home. Only Roscoe can do the story justice.

"Both the North Fork and Middle Fork of the Feather River had to be scouted out and on foot. The McCloud River, Sacramento and Shasta canyons had to be studied as well as the Old Oregon Trail over Scott Mountain. About the most interesting of all was a 45-mile motorboat trip down the lower Klamath River with its many rapids all of which we ran except one."

Mr. Bedford was transferred to District 1 in 1923 where he remained until 1928, when he obtained a leave of absence and went to Cuba for ten months. Upon his return in 1929 he was assigned to Central Headquarters in Sacramento to study the entire State highway system. He is there today piling up more years of service with the Division of Highways.

CREW MAN INJURED

Protecting the motoring public sometimes has its hazards for the men of the Maintenance Department. Just recently on the Coast Highway, north of Ventura, a crew under Foreman D. MacDougall of El Rio was removing mud, which had washed down on to the pavement. It was 2 o'clock in the morning. With flares burning, an abundance of red lanterns set out and with flagmen stationed at either end of the barricades, a motorist came along at a high rate of speed, ran by the flagman and, cutting over to the wrong side of the road, crashed into the rear of one of the Division of Highway cars with such force as to fling it upon George Rhodes, a member of MacDougall's crew. Rhodes suffered a concussion of the brain and a broken leg and was unconscious for a week. He is, fortunately, recovering.

First Chappie: "My brother thinks a football coach has four wheels."

Second Chappie: "Ha! Ha! And how many wheels has the bally thing?"

Highway Officialdom Eager for Message of Chief MacDonald

(Continued from page 12)

tain highways, for we are ever learning and ever striving to keep in the foremost of the ranks of practical highway construction engineers. However, the most of our delegates will find their keenest interest in the words of Thomts H. MacDonald, Chief of the Bureau of Roads, because the future of highways for the next few years depends upon the policies of the Federal Government.

This is true because Federal aid is so necessary, especially when as in California, so much State highway funds are taken by counties, cities and other political subdivisions. Chief MacDonald has intimated that he will have important information to impart to highway builders of America at this meeting.

Any industry so progressive as that relating to the automobile can not nap and all the progressive highway officials in the United States will be in attendance when Chief MacDonald chooses to announce the Government road policy for the ensuing years.

Arrangements for this great meeting are being handled by Harry A. Hopkins, Chairman of the California State Highway Commission and the engineers of the State Department of Public Works as well as the Director thereof, Earl Lee Kelly.

HIGHWAY COMMISSION AGAIN COMPLETE

(Continued from page 19)

During the illness of Mr. Stanton former State Senator Ray Ingels of Mendocino succeeded Dr. W. W. Barham of Yreka as commissioner on May 21, 1935. Mr. Ingels became Director of the Department of Motor Vehicles in August, 1935, thereby creating a vacancy on the board. On July 24, 1935, Charles D. Hamilton succeeded Frank A. Tetley on the commission. Mr. Hamilton died suddenly April 24, 1936.

On May 6, 1936, Governor Merriam named Mr. Jasper of Fortuna to fill the vacancy caused by the resignation of Mr. Ingels and appointed Mr. Judah of Santa Cruz to succeed Timothy A. Reardon of San Francisco, who resigned. In July, Mr. Hart was appointed to succeed Mr. Hamilton.

Pan-American Highway Cuts Through Lush Tropical Jungle

(Continued from page 10)

implements contrasting with the factory city of Monterey.

In Victoria, with its 400-year-old cathedral, its ancient cabs and drowsing natives, our party lunched as the guests of the Governor of the State of Tamaulipas. We departed in the late afternoon for Villa Juarez where we were entertained at dinner and where we remained over night.

THROUGH TROPICAL JUNGLE

After leaving Victoria the visitor is impressed with the lush tropical jungle through which the Pan-American Highway passes, a route that was cleared with machetes. Here thousands of parrots and tropical birds chatter in the trees and if the motorist from the States inquires he will learn he has crossed the Tropic of Cancer and is in the Tropical Zone.

South of Victoria the highway crosses a number of bridges over tropical rivers and streams and runs through a country that has changed little in thousands of years. Here live the descendants of the ancient Huastecs and they live much as their forefathers did. However, the new highway is destined to change this primitive land and the lives of its natives.

AMERICAN MONUMENT DEDICATED

We left Villa Juarez at 8 o'clock on the morning of July 3d for Chapulhuacan, where we lunched and from which we departed in the afternoon for Zimapan. Here we had dinner, enjoyed a serenade and fireworks and dance and remained over night. Early the following morning the trip was resumed and we arrived at Pachuca before noon, participating in the laying of the cornerstone of the monument dedicated by the American colony to the people of Mexico in honor of the inauguration of the Mexico City-Laredo Highway.

Leaving Tamazunchale, the altitude of which is about 330 feet, the motorist on the new highway will again be impressed with the easy grade which leads up into the mountains so suddenly that it comes as a distinct surprise to look back and down and see far below a silver ribbon that is the Moctezuma River. It is the road between Tamazunchale and Jacala that will attract the attention of engineers. Here, indeed, engineering skill accomplished wonders.

AWED BY SCENIC GRANDEUR

The road climbs steadily to an elevation of 6000 feet and the scenic beauty of the mountains and jungles awes one with its grandeur.

At Pachuca our party was welcomed by State and city officials and we lunched as the guests of the Governor of the State of Hidalgo. We departed for Mexico City in the afternoon.

American motorists who travel the new highway to Mexico City doubtless will ever after remember with delight the road from Jacala to the Mexican capital, a distance of 166 miles.

At Jacala the elevation is about 4800 feet. Ahead to the south are towering mountains and one is inclined to doubt that a highway runs through them. But the Pan-American Highway does and leads the motorist up to an elevation of 8200 feet before dropping down into Mexico City.

We arrived at Atzacoalco on the evening of July 4th where, after a ceremony during which the keys to the City of Mexico were presented to our party, we entered the capital. A dance at the American Club given that night by the American Chamber of Commerce, the American Colony and the American Legion was the beginning of a three-day round of entertainment for the visiting delegates.

The American delegation returned to Laredo by train vividly impressed with the magnificent highway it had seen and convinced that soon thousands of motorists will be rolling down to Mexico City from the United States fully justifying the ten years of arduous labor which made possible the Pan-American Highway.

"Shall I take you to the zoo?"

"No, if they want me, they'll come after me."—*Siwasher.*

Federal Aid For Secondary Roads

Provision in the Hayden-Cartwright bill for Federal aid for secondary and farm-to-market roads is one of the most important developments in national highway legislation. The handicap of dirt roads is a serious cost factor in the marketing of farm products, and in many mining operations. In this day of the automobile, mudless roads are a necessity. They must not only be mudless, but they must be aligned to accommodate modern motor traffic.

Stimulation of construction of modern feeder roads is a wise national policy. Not only is it welcomed by all thinking people, but it will prove so popular that the $25,000,000 per annum set up in present legislation will be expanded in the future.

Federal aid for feeder roads is the natural outgrowth of Federal aid for primary roads. As in the case of primary roads, the feeder roads will be under the broad jurisdiction of the U. S. Bureau of Public Roads, which will set up standards with which specifications and construction must comply. And again, as in the case of primary roads, the Federal funds must be matched by local funds. This, too, is a wise policy.

The benefits of Federal aid for feeder roads will be far reaching.—*Highway Builder and Engineer.*

2,245,042 MOTOR VEHICLES REGISTERED IN SIX MONTHS

With 2,245,042 motor vehicles "tagged" in the first six months of this year, Gov. Frank F. Merriam announced collection of registration fees has provided an apportionment of $6,295,526 for construction and maintenance of roads and highways.

Of the total apportionment, $3,147,763 will go to the 58 county governments for road development. A like sum will be made available to department of public works for State highway projects.

A man on trial for his life was being examined by a group of alienists. Suddenly one doctor jumped up and shouted at him: "Quick, how many feet has a centipede?" The man came back in a dry, dry voice: "Gad, is that all you have to worry about?"—*Troy (N. Y.) Times-Record.*



Location of proposed Arroyo Seco Parkway through Victory Park, Los Angeles, showing paved stream channel at left of picture.

Streets Cross Above Depressed Parkway

(Continued from page 4)

design is arranged so that there will be no left-hand turn across lanes of traffic, which is a very desirable feature from the standpoint of safety and noninterference with traffic.

The proposed depressed parkway through South Pasadena will enable all through traffic to pass through that city without using any of its surface streets, eliminating the hazards and interference with local traffic. All the existing streets in South Pasadena (Arroyo Drive, Grand Avenue, Orange Grove Avenue, Prospect Avenue, Meridian Avenue, Fremont Avenue and Fair Oaks Avenue) will be carried across the depressed parkway on ornamental bridges which will be at the grade of the existing street and will be the same width between curbs as the existing street with the sidewalks additional.

More persons will be enabled to enjoy the long, narrow strip of park in the Arroyo Seco by the construction of this parkway than would ever get benefits from the park in any other way.

Because of the safe and quick access which the Arroyo Seco Parkway would provide to the center of Los Angeles, the areas contiguous to and served by the parkway will naturally become more desirable from a residential standpoint. As a consequence, land values will be enhanced, and the local business centers, which get their support almost entirely from the local residents, will receive the impetus which would come from increased population in the adjacent territory.

Upon recommendation of the officials and interested citizens of the cities of Los Angeles, South Pasadena and Pasadena, the last State Legislature designated this Arroyo Seco Parkway as a secondary highway in the State Highway System. This action makes the project eligible to receive allotments from the city's share of the gasoline tax in the three cities mentioned, and funds have already been set aside by the cities of Pasadena and South Pasadena for starting work on surveys, plans and acquisition of rights of way.

The city of Los Angeles, with emergency Federal funds, has already done a large amount of work in constructing a paved channel to take care of the Arroyo Seco drainage between Avenue 52 and San Pascual Street in South Pasadena. In connection therewith they have graded a considerable portion of the roadbed for the Arroyo Seco Parkway.

The Los Angeles officials expect this WPA project to continue, and are hopeful that the entire channel will be paved within the coming year.

Because of the fine spirit of cooperation existing between officials of the three cities, of the county of Los Angeles, of the State and the Federal Government, an unexpected amount of progress already has been made on the project.

Subway Drained by Two Automatic Pumps

(Continued from page 11)

at the top. The three foot sidewalks on both sides consist of a four inch reinforced concrete surface. The sidewalk and curb extend through the depressed portion. The drainage of the subway section is handled by a series of catch basins, a sump, and two five inch automatic electric pumps.

The pavement is protected from capillary action that might cause the rise of water-soluble salts that attack concrete, by a seal of Grade "E" asphalt placed one foot below subgrade. This membrane also shuts out surface waters from any expansive subgrade soils that lie below the pavement. The section between the seal and the subgrade is backfilled with selected imported borrow.

PROJECT COST $124,000

A concrete well on either side of the project permits possible future removal or repairs to the pipe line. The 8" carrier pipe is also encased in a 12" pipe as an insurance against breakage of the line and flooding of the depressed portion with hot oil.

This project provided for approximately 32,000 man-hours of labor.

The total cost of the project was $124,000, which covered the contract payment, State furnished materials, railroad work, and other incidental expenditures.

Angeles Crest Road Opens Mountain Area Close to Metropolis

(Continued from page 2)

labor, which is employed principally in clearing right of way grading and erosion control work, considerable power equipment, such as power shovels, trucks and tractors, will be used, thereby speeding up the work.

The highway from Foothill Boulevard at La Canada to Red Box is 12.7 miles in length and has been constructed by the State Division of Highways in successive units, starting in 1929 at Haskell Avenue in La Canada and being completed to Red Box late in 1934. The construction of the 1.3 mile section which is planned as a connection between the convict work and Red Box should be completed during the summer of 1937.

EASIER COUNTRY AHEAD

With this improvement the Angeles Crest Highway will be graded in a northeasterly direction from the Foothill Boulevard at La Canada to Charlton Flats, a distance of 21 miles. A contract has already been completed by the U. S. Bureau of Public Roads from Big Pines westerly and a connection eventually will be made with the portion under construction from La Canada.

The portion yet to be constructed, after present projects have been completed, will be over easier country, but at a high elevation, extending from Charlton Flats through Chilao Flats, Buckhorn Flats, Mt. Islip Saddle, and connecting with the end of the five-mile completed section just north of New Mt. Baldy.

OPENS MOUNTAIN AREA

This route is through extremely scenic territory and will open up for recreational purposes the largest mountain area within easy access of the densely populated Los Angeles metropolitan district.

The Angeles Crest Highway from La Canada to Big Pines Park will be about 46 miles in length. The total cost of the 25 miles already constructed, or under construction, is approximately $2,500,000, with 21 miles of this route yet to be completed.

The value of this highway to the more than two million residents of the metropolitan area of which Los Angeles is the center, can hardly be estimated.

Relocation Eases Curves and Grades on Big Pines Road

By A. EVERETT SMITH, Assistant Highway Engineer

CONSTRUCTION of modern roads leading to recreational centers is one of the responsibilities of the State in the development of the California highway system, and as a unit in this phase of development in Southern California, the Division of Highways is pushing work forward toward the completion of satisfactory routes from the metropolitan districts to Los Angeles County Park at Big Pines in the Sierra Madre Mountains.

Construction of the Angeles Crest Route, which will be the main approach from the west to this popular recreational spot has been under way for some time and many miles have been completed. As the completion of this 64-mile route will take some time, the Division of Highways now has under way the construction on new alignment and grade a short stretch of highway connecting the park with the San Bernardino-Lancaster highway at the head of the Cajon Valley.

EASY CURVES AND GRADES

This new highway winds its way on easy curves and grade up Wild Horse Canyon, over Sheep Creek Summit, across Sheep Creek and along Swarthout Creek to Big Pines. Lying wholly within National Forest boundaries, the route rises from an elevation of 4686 feet near its eastern terminus to an elevation of 5855 feet at Big Pines.

Construction of the new location covers a distance of 4¾ miles and will provide a highway which is a vast improvement over the old road. The maximum grade is 6.3% and the minimum radius of curvature is 1000 feet, whereas the old road has 7 miles of excessively steep grades where cars now toil up in second or low gear. The central twenty feet of the 30-foot graded roadbed on the new road will be oil treated.

THROUGH ROUGH CANYONS

Under the supervision of Resident Engineer C. V. Kane, construction on this route is well advanced; rough grading and a 50-foot span, reinforced concrete bridge over Sheep Creek being complete. Road oiling operations are now in progress and it is expected that the work will be completed by the end of the month.

The thousands who annually visit the Big Pines area for both summer vacations and outings and winter sports activities will appreciate this new and modern highway cut through the rough canyons of this portion of the Sierra Madre, bordered with picturesque Joshua trees, Pinyon pines and, at the terminus, the large pines of Los Angeles County Park.

"Great Work and the Whole State Profits from It"

Better, safer roads! That is a policy diligently pursued by the California Highway Commission.

Improvements most recently announced will benefit Orange County and motorists who travel the Coast Highway from Seal Beach to Newport, and who drive the Santa Ana Canyon road.

More than $300,000 will be spent on those projects, with the result that the Coast Boulevard between the points named will have a four-lane width.

The canyon route will have better pavement and new bridges on the section now contracted. All told, about 11 miles of road will be made more serviceable and more safe.

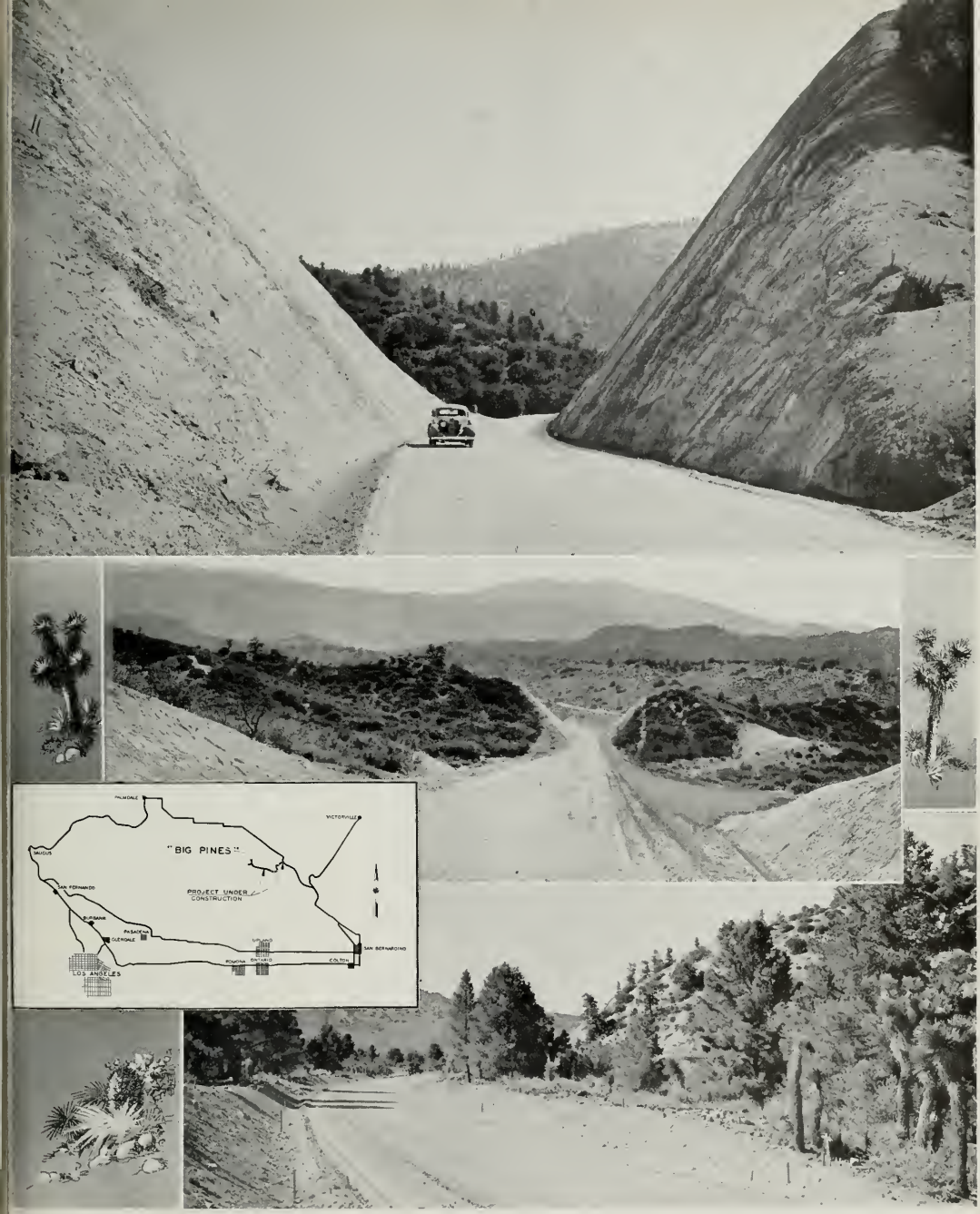
It is a great work; and the whole State profits from it.—*Pasadena Star-News.*

It is said that the tiger has a more harmful bite than the lion.

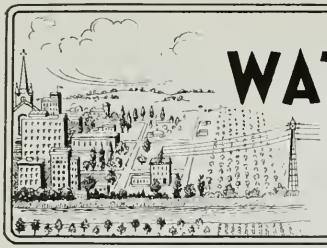
Somebody must have gone to great pains to find that out.

"I'd like a couple of hard boiled eggs to take out," said the young fellow to the girl at the lunch counter.

"All right," replied the waitress with a smile, "you'll have to wait. Mamie and I don't get off until 10."



Scenic views along new highway connecting Los Angeles County Park at Big Pines with the San Bernardino-Lancaster highway at head of Cajon Valley. Inset map shows where project is under construction. Pictures show rough grading complete before oiling. Upper photo exemplifies type of cuts necessary to eliminate dangerous grade on old highway shown in background of center picture. Lower picture reveals easy grade of new highway.



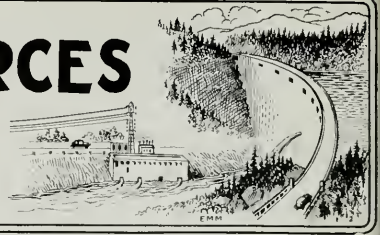
DIVISION OF WATER RESOURCES

OFFICIAL REPORT

FOR THE MONTH OF

July, 1936

EDWARD HYATT, State Engineer



Announcement that cooperative bank protective work on flood control projects by the State and Federal government is about to be resumed and the progress of preliminary investigations preparatory to starting construction on initial units of the Central Valley Project are included in the following monthly report of the State Engineer together with news of the irrigation districts, dam applications, water distribution, topographic mapping and other activities of the Department of Water Resources.

Among interesting details are results of a research in methods of runoff forecasting showing an error of only ten per cent from actual runoff figures.

IRRIGATION DISTRICTS

Districts that have recently received approval of the Reconstruction Finance Corporation for loans include the Anderson-Cottonwood District which has been offered $282,500 for refinancing its outstanding bonded indebtedness, and the Richvale District which will receive $113,500 to purchase water rights and build canals for a 2000 acre tract that will be added to the district.

Continued activity in the formation of new irrigation districts in San Joaquin Valley is evidenced by the filing of three more petitions with the board of supervisors of Tulare County. Copies of organization petitions that were presented by the proposed Lindmore, Ivanhoe and Exeter irrigation districts have been filed with the State Engineer.

In addition to matters previously reported, the following petitions were acted upon by the District Securities Commission at the last regular meeting held in San Francisco, June 12, 1936:

Application of Big Springs Irrigation District for approval of the first refunding issue of bonds in the amount of $26,000 for certification by the State Controller was granted.

Requests of Waterford Irrigation District and Banta Carbona Irrigation District for consent to execute agreements with bondholders, waiving the statute of limitations for a period of two years, were approved in so far as consent of the commission was necessary.

FLOOD CONTROL AND RECLAMATION

Relief Labor Work

Work has been continued on clearing of the Feather River channel above Marysville in Yuba County and the Sutter By-pass above Long Bridge. An average of 85 relief laborers have been employed. A new application has been submitted for a WPA project to clear in the Feather River channel.

Bank Protection Program

The cooperative program for bank protection work by the State and Federal Government is about to be resumed, and the program for the current year is awaiting approval in the Division Engineer's office. Several field examinations have been made at the places where work is to be performed.

Sacramento Flood Control Project

This Division is now engaged in raising the concrete walls of the Clara Packer pumping plant about six miles above Colusa on the west side. This work is being done in connection with the reconstruction of the river levee, which is now complete up to that plant.

The moving and rearranging of buildings and other improvements on the levee right of way on the Boggs and Watt ranches between Colusa and Princeton have been continued.

SUPERVISION OF DAMS

Application for alteration of the Lafayette dam in Contra Costa County was filed on June 25, 1936, by the East Bay Municipal Utility District. This application was approved on July 6, 1936.

Application for alteration of the Huntington Lake dam in Fresno County was filed on July 3, 1936, by the Southern California Edison Company, Ltd.

Application for the repair of Lake Fordyce Dam in Nevada County was approved on June 27, 1936. This dam is owned by the Pacific Gas and Electric Company.

Application for the repair of the Silver Lake Dam of the city of Los Angeles was approved on July 8, 1936.

Accelerated progress is being made on the construction work now under way on the O'Shaughnessy, West Valley, Shelfield, Lake Hodges, Caljaco, San Gabriel No. 1, Grant Lake and Arcata dams.

Practically all dams in the northern part of the State have been inspected and contacts made and arrangements completed for repairs and alterations made necessary by the heavy runoffs of the last season.

The usual maintenance and operation inspections have been made as well as the necessary inspections of repair and alteration and construction work under way.

WATER RIGHTS

Supervision of Appropriation of Water

Thirty-two applications to appropriate water were received during June; 13 were denied and 19 were approved. In the same period 6 permits were revoked and 17 passed for license.

Inspections were made preliminary to the issuance of licenses, or revocation upon the ground of failure to comply, in Kern, Los Angeles, San Bernardino, Tehama, Modoc, Lassen, Plumas, Sierra, Nevada and Placer counties.

Water Distribution

Water master service in the following districts was continued throughout the month: Owl, Soldier, Emerson, Cedar, Deep and Mill Creek Water Master Districts (in Surprise Valley, Modoc County); New Pine, Davis, and Franklin Creek Water Master Districts (in Goose Lake Valley, Modoc County); South Fork of Pit River, Pine Creek, Hot Springs Valley and Big Valley Water Master Districts (in Modoc and Lassen counties); Shasta River Water Master District (in Siskiyou County); Hat, Burney and Cow Creek Water Master Districts (in Shasta County).

SACRAMENTO-SAN JOAQUIN WATER SUPERVISION

During the past month the activities of this office have been toward securing data from which to tabulate a report showing the diversions, return flow, stream flow and acreage irrigated in the Sacramento-San Joaquin territory. Three engineers are in the field securing these data.

A mimeographed report of this work for 1935 has been completed and is being mailed to interested parties.

A marked decrease in stream flow was noted during the past month and it can be expected that a corresponding increase of salinity soon will be noted in the delta.

For the purpose of comparison with other years the following salinity data are presented.

Salinity

Station	1932 Max.	1932 7/1	1933 Max.	1933 7/1	1934 Max.	1934 7/1	1935 Max.	1935 7/1	1936 Max.*	1936 7/1
Point Orient	1720	1360	1800	1490	1840	1770	1720	1480	----	1440
Bullshead Point	1320	630	1380	800	1640	1360	1260	800	----	660
O and A Ferry	620	54	900	340	1200	700	540	136	520	70
Antioch	400	2	580	34	960	440	290	10	260	9
Collinsville	166	2	380	84	760	620	88	20	80	8
Jersey	150	1	280	11	670	200	86	3	75	2
Rio Vista	28	1	130	----	520	70	12	----	6	2

* Estimates, from April Bulletin of California Cooperative Snow Surveys.

COOPERATIVE SNOW SURVEYS

The past month has been devoted exclusively to continuing, in the office, the research work in methods of runoff forecasting. The effects of all modifying factors have been investigated and of these, that of precipitation during the April-July period, alone has been evaluated. Insufficient data are as yet available to justify assigning numerical values to any of the other factors and their effect will for some time to come have to be allowed for in a general way.

As a result of this study new curves for forecasting the runoff by means of the April 1st snow pack measurements have been drawn up for all basins. The following tabular summary shows for the 45 subdivisions of the 15 major basins of the western slope of the Sierra the maximum divergence between actual runoff and that forecast from these new curves.

Indicated Error of Forecast

All Years 1930–1936 Inc. (7 years)

	Number of basins
Under 10 per cent	14
10 to 20 per cent	10
Over 20 per cent	14
More data needed	7

The years 1931 and 1934 were almost record dry years and in such years accurate forecasts are found to be very difficult. If these years be eliminated it is found that for the remaining years the tabulation becomes as follows showing that in more than half the basins the error would be only 10% or less.

Indicated Error of Forecast	*Number of basins*
Under 10 per cent	25
10 to 20 per cent	9
Over 20 per cent	4
More data needed	7

To further reduce the discrepancies between forecasts and actual runoff new courses appear desirable in twelve of the basins, and because of popular demand several courses should be established in three basins not covered by the present program.

FEDERAL COOPERATION—TOPOGRAPHIC MAPPING

Office work was completed during June on the Paynes Creek Quadrangle in Tehama County and progress was made on the field work in connection with Tobias Peak Quadrangle in Kern and Tulare counties and San Bernardino No. 4 Quadrangle in San Bernardino County. Field work was initiated on the Downieville No. 1 Quadrangle, a new Federal sheet in Plumas County. The advance sheet of Eureka Quadrangle covering an area in Humboldt County is now available. This is published on the scale of 1:48,000, the contour interval 25 feet.

The final quadrangle sheet of Dudley Ridge in Kings County is also available. This is published on the scale of 1:31,680 and contour interval of 5 feet, and embraces a portion of Kettleman Hills area.

The Red Mountain Quadrangle sheet which was done by Los Angeles County in cooperation with the Geological Survey is now available. This is published on the scale of 1:24,000, contour interval 25 feet and covers an area in the northwest part of the county, in the vicinity of Elizabeth Lake and San Francisquito Canyon.

The final sheet of Bell Quadrangle, now available, was done by Los Angeles County in cooperation with U. S. Geological Survey. It is a cultural revision of a sheet previously published. The scale is 1:24,000, contour interval 25 feet, and covers a portion of Los Angeles County in the vicinity of Vernon, Montebello and Downey.

WATER RESOURCES

South Coastal Basin Investigation

Good progress has been made in the field and office on the South Coastal Basin Investigation during the present month.

San Luis Rey River Investigation-San Diego County

The investigation and survey of the San Luis Rey River in San Diego County being made by the Division of Water Resources in cooperation with W.P.A., city of Oceanside, county of San Diego and Carlsbad Mutual Water Company, has been resumed after a temporary suspension owing to lack of W.P.A. funds. This work is for the purpose of securing data and preparing plans for flood control, rectification of the river channel and the conservation and utilization of the waters of the San Luis Rey River.

Central Valley Project

The United States Bureau of Reclamation is exerting every effort to complete, at an early date, the preparation of plans preparatory to starting construction on the initial units of the project. Preliminary investigations and exploration work have been carried on during the month at Kennett and Friant dam sites and surveys continued along the Contra Costa conduit and Friant-Kern canal by the United States Bureau of Reclamation. Appraisers are working in the field evaluating lands and necessary rights of way for the construction of the project. The State Department of Public Works and all State agencies interested are assisting the United States Bureau of Reclamation in every way possible in order to facilitate the early commencement of construction work on the initial units of the Central Valley Project.

California Is Justly Proud of Her Good Roads, Says Editor

(From Monterey Park Progress)

It would be hard to find a State which has more and better highways, in proportion to the population, than California. We have some of the best right here in Monterey Park. Our citizens have paid considerable sums for them—and are still paying. But they are glad they have the highways; the roads are worth the money spent on 'em.

An while on this subject it is right to say much praise should be given to the Division of Highways of the California Department of Public Works for its great accomplishments in recent years. Many local people can remember when most of our thoroughfares were dirt roads—dusty in summer, muddy in wet winters. The California Progress Review of San Francisco remarks:

"Now that we have these broad, smooth highways extending in every direction over the vastness of California, we sometimes forget what long years of public effort, hope and sacrifice it took to build them.

"Mere muddy trails they were, at first. Then by 1913, when California boasted 100,000 autos, the "good roads movement" began. Political candidates rose to power or fell ingloriously over the issue of good roads. Newspapers carried on fighting campaigns for good roads.

"Today we have them—the best in the world. They have cost us more than a billion dollars, and twenty-five years of toil. But they were built by and for the public, and California is justly proud of them."

"Do you wish the court to understand that you refuse to renew your dog license?"

"Yes, your honor, but——"

"We want no 'buts.' The license has expired."

"Yes, and so has the dog."

Man blames Fate for other accidents but feels personally responsible when he makes a hole in one.

FOXEN PERSECUTED FOR AID GIVEN FREMONT

(Continued from page 8)

pitched battle. Determined to prevent the impending slaughter, Foxen at last revealed to Fremont the scheme of the Californians.

Fremont was discouraged. Michael J. Phillips has written in his book, "A Pathfinder Without Fame," of that momentous scene when Foxen exposed to Fremont the plan of the Californians. Phillips says that Fremont had exclaimed:

"Two days from here through Gaviota Pass and the road is open to Santa Barbara."

FOXEN REVEALS PLOT

"It is open when you reach the Pacific." said Foxen, "but if our friends, the Californians, have their way you will never reach it, nor one of your men."

"What do you mean?"

"Here, all but through the pass, where the creek winds beside the trail, the walls are high and straight. There is a defile for more than a rifle shot where two horses can not travel abreast. It is worst by the Indian's Face, for the road turns sharply. You could make no speed."

"The Indian's Face?" interrupted the soldier.

"Yes. The great profile of a chief which the Lord has chiseled in the rock. It sticks out over you like a ship's figurehead. Well, Fremont, the tops of the cliffs hemming you in are covered with loose rocks. They are from the size of your head to the displacement of a fair-sized bark. There is where the Californians are waiting for you.

"Those from the north have been hovering on your flanks, as you know, since you came into this country. Messengers have brought every man who can ride and shoot from Santa Barbara. They line the Pass of the Gulls for a mile. Trains of powder will be laid to the biggest rocks. When your army is inside the defile, the powder will be lighted above and below, blocking it with the rocks that will rain down.

"And there you are, trapped! They will kill you all by rocks or rifle fire. You can not escape if you enter the pass, for when you leave your camp the scouts on those mountains will cut ahead of you on fast horses to give the word. They will beat you to Gaviota by hours—by a day."

"How do you know all this?"

The Englishman shrugged his broad shoulders.

"They are like children in many ways," he explained. "They talk it in the corners, and my boys catch a word here and there. The women tell my wife. Why, I could write the log of it for you."

"There is no way around Gaviota?" Fremont asked.

"No way, Fremont."

"My Indians," said Fremont, "could climb those look-out hills and take the sentinels. There would be no one to carry the word to Gaviota."

Don Julian shook his head.

ONLY WAY OUT

"The Californians are not such fools. They have scouts at the mouth of the pass a long way from the Indian's Face who, afoot on paths that even I do not know still would take the word as you crossed the valley of the Santa Ynez. No, Fremont, the Pass of the Gulls is closed to you."

The soldier's voice trembled with emotion when he spoke.

"Don Julian, I may not turn back. I must go on. I can not tell you how much it means if I should fail. There must be another way to the south. If I can get to Santa Barbara and Los Angeles, Mexico's grip is broken on all of California."

Don Julian rose leisurely and stretched his ponderous frame as he smiled.

"There is another way, Fremont. I did not say there wasn't. Look you——"

And he spoke rapidly for five minutes. When he had finished, Fremont's eyes were sparkling with jubilation and resolve.

What Benjamin Foxen had told Fremont was that he knew another way to Santa Barbara—through San Marcos Pass—that the Californians would not be expecting him that way; that the Americans could march into Santa Barbara at daylight; that they would find there only women and children and old men at mass, and that he could take the city without bloodshed.

And so Foxen and his son Guillermo, then a lad of seventeen, guided Fremont through San Marcos on Christmas Day, 1846. A cold rain was falling. Foxen and his son helped the Americans drag their cannon up precipitous mountain sides. At the top of the pass, Foxen left Fremont and the latter, with Guillermo showing the way, entered Santa Barbara.

CAPTURED SANTA BARBARA

The situation was exactly as Foxen had said it would be. The inhabitants of Santa Barbara who were not at Gaviora Pass awaiting their prey, were in church. They emerged in astonishment to find their town captured. Not a shot was fired. Fremont raised the Stars and Stripes. History had been made with the help of Benjamin Foxen. The conquest of California, so far as Santa Barbara was concerned, was concluded. There was nothing the British men-of-war could do about it.

Benjamin Foxen's allegiance to the Americans cost him dearly. In "A Community History of Santa Barbara," written by Laurence L. Hill and Marion Parks, there is this account of the penalty Foxen paid for aiding Fremont:

"Don Julian Foxen appeared at the time to the disappointed Californians as nothing less than an execrable traitor. Primitive justice of the old days was enforced, and he paid a dear price for his aid to Fremont and the cause of American possession of California.

"Three times he was burned out of his home in Foxen Canon. His herds of cattle and horses were repeatedly stampeded from Rancho Tinaquaic, until at last the ranchero was forced to retire from his beautiful canon and live in a less isolated region for seven years after the conquest.

BUILT STAGE ROAD

"Gradually the situation mended, of course, and Don Julian was enabled to return to a life of peace and comfort on the Rancho Tinaquaic.

"Some years later, it was Don Julian who directed again the opening of the road through San Marcos for a stagecoach route. Over Fremont's trail they built a wagon road."

Along the steep slopes of the Santa Ynez Mountain range immediately north of the city of Santa Barbara, the historic old San Marcos Pass Road was reconstructed by the Division of Highways, largely on new alignment. The motorist now has available an alternate route of easy grades and curves, some ten miles shorter than the Coast Highway.

Known as State Route No. 80, the San Marcos Pass Road was taken into the State system in 1931. It extends northerly from the Coast Highway at a point about two and one-half miles west of Santa Barbara City and follows up a steep ridge on the southern slope of the Santa Ynez Range. Crossing the top of the range through San Marcos Pass, the road thence follows down the Santa Ynez River Valley and through the small communities of Santa Ynez and Los Olivos, rejoining the Coast Highway at Zaca, about fifty miles north of Santa Barbara.

GAVIOTA GORGE WIDENED

Affording a mountain shortcut route, this road also serves a large and popular vacation and recreational area for the residents of Santa Barbara and vicinity. From points high up on the mountain range, the motorist is afforded delightful views of Santa Barbara and neighboring communities and looking westward, across

(Continued on page 32)

Highway Bids and Awards for July, 1936

ALAMEDA COUNTY—Between 1.9 miles north of Irvington and Alvarado, about 6.0 miles to be surfaced with plant-mix surfacing. District IV, Route 69, Section A. Hanrahan Company, San Francisco, $55,856; Pacific States Construction Co., San Francisco, $53,445; Chas. L. Harney, San Francisco, $50,459; Eaton & Smith, San Francisco, $46,527; Union Paving Co., San Francisco, $47,804; Independent Construction Co., Ltd., Oakland, $45,719. Contract awarded to Jones & King, Hayward, $37,425.60.

BUTTE COUNTY—Between Biggs Road and Chico, about 1.8 mile widen portions ex. rd. bed construct cr. run base bdrs., gr. fine pl. mix surf. District III, Route 3, Section B, C. Pacific States Construction Co., San Francisco, $117,239; Larsen Bros. and Harms Bros., Sacramento, $99,547. Contract awarded to A. Teichert & Son, Inc., Sacramento, $97,736.70.

CONTRA COSTA COUNTY — Furnish and apply plant-mix surface between county road to Byron and easterly boundary, 4.1 miles. District IV, Route 75, Section D. Ransome Co., Emeryville, $11,722; C. C. Wood, Stockton, $11,700; C. L. Harney, San Francisco, $13,377; Hanrahan Co., San Francisco, $13,787; Pacific States Constr. Co., San Francisco, $10,884; E. A. Forde, San Anselmo, $10,035; Wood & Bevanda, Stockton, $16,597. Contract awarded to Lee J. Immel, Berkeley, $9,506.

EL DORADO COUNTY—About 1½ mile north of Meyers, about 0.6 mile to be graded and surf. and rd. mix surf. trmt. applied Const. reinf. conc. bridge. District III, Route 28, Section A. E. T. Lesure, Oakland, $71,695; Larsen Bros. & Harms Bros., Sacramento, $53,797; Heafy-Moore Co., Oakland, $68,662. Contract awarded to J. V. Galbraith & Don A. Canevari, Santa Rosa, $50,102.32.

KERN COUNTY—A reinforced concrete bridge across North Fork Kern River, 0.7 mile north of Isabella, 2-47'10" and 3-60' spans on concrete piers and 0.35 mile roadway to be graded and treated with liquid asphalt. District VI, Route 142, Section F. Heafy-Moore Co., Oakland, $58,321. Contract awarded to Parish Bros., Los Angeles, $52,426.

KERN COUNTY—Between 3 and 4 miles northeast of Taft, 0.4 mile to be graded and surfaced with road-mix surfacing on crusher run base. Timber bridge to be constructed. District VI, Route 140, Section A. Rexroth & Rexroth, Bakersfield, $36,941. Contract awarded to John Jurkovich, Fresno, $36,096.

LOS ANGELES COUNTY—Between Palmdale and 14.3 miles westerly. About 14.3 miles road mix surface treatment to be applied to existing shoulders. District VII, Route 23, Sections D, E. C. W. Wood, Stockton, $????; Southern California Roads Co., Los Angeles, $20,531; J. E. Haddock, Ltd., Pasadena, $22,531; Oilfields Trucking Co., Bakersfield, $20,958; Kovacevich & Price, Inc., Southgate. Contract awarded to A. S. Vinnell Co., Los Angeles, $19,237.50.

LOS ANGELES COUNTY—Between Palmdale and Lancaster, 7.1 miles to be surfaced with road-mixed surfacing. District VII, Route 23, Section F. Oswald Bros., Los Angeles, $20,805; Southern California Roads Co., Los Angeles, $17,687; A. S. Vinnell Co., Los Angeles, $18,255. Contract awarded to J. E. Haddock, Ltd., Pasadena, $15,372.50.

LOS ANGELES COUNTY—25th Street between Palos Verdes Coast Highway and Patton Avenue, about 2 miles to be graded, surf. with imp. sel. mtl. and Class "B" seal coat applied. District VII, Route feeder. Southern California Roads Co., Los Angeles, $161,721; United Concrete Pipe Co., Los Angeles, $205,705; Oswald Bros., Los Angeles, $171,708; C. R. Butterfield, San Pedro, $156,951; C. O. Sparks & Mundo Eng. Co., Los Angeles, $160,538; Dimmitt & Taylor, Los Angeles, $159,642; Sully-Miller Cont. Co., Long Beach, $184,503. Contract awarded to R. E. Campbell, Los Angeles, $141,286.75.

LOS ANGELES COUNTY — Rosemead Boulevard between Longden Avenue and Fairview Avenue, about 1.0 mile to be graded and paved with P. C. Conc. District VII, Route 168, Section C. Matich Bros., Elsinore, $53,908; Oswald Bros., Los Angeles, $60,294; George R. Curtis Pav. Co., Los Angeles, $56,753; C. O. Sparks & Mundo Engineering Co., Los Angeles, $55,407; Griffith Co., Los Angeles, $54,328. Contract awarded to J. E. Haddock, Ltd., Pasadena, $53,834.50.

LOS ANGELES COUNTY — Between Calabasas School and Brent Jct., about 2.2 miles to be graded and surfaced with pl. mix. surf. District VII, Route 2, Section C. Geo. J. Bock Co., Los Angeles, $115,631; Oswald Bros., Los Angeles, $138,852; C. G. Willis & Sons, Inc., Los Angeles, $133,310; Gibbons & Read Co., Burbank, $121,895; J. E. Haddock, Ltd., Pasadena, $120,085; Griffith Co., Los Angeles, $121,110; C. F. Robbins, Los Angeles, $115,058. Contract awarded to C. O. Sparks & Mundo Engineering Co., Los Angeles, $110,330.50.

MENDOCINO, HUMBOLDT, DEL NORTE COUNTIES—At various locations, 21.5 miles, road-mix surfacing to be furnished and stockpiled. District I, Route 48, Section C; D. 1; C. G; A. Contract awarded to Chas. Harlowe, Jr., Oakland, $68,759.35.

MODOC and SISKIYOU COUNTIES—Between 1.7 miles southeast of Tule Lake and Oregon state line. About 5.2 miles long. Penetration oil treatment to be applied. District II, route feeder. Dunn & Baker, Klamath Falls, Ore., $7,835; Hayward Building Mtl. Co., Hayward, $8,911. Contract awarded to Lee J. Immel, Berkeley, $7,535.

MONO COUNTY—At grade crossings near Chalfant, Hammil, and 2.5 miles south of Benton, 1.8 miles in length to be graded and surfaced with road-mix surface treatment. District IX, Route 76, Section A, B. Leo F. Piazza, San Jose, $12,560; A. S. Vinnell Co., Los Angeles $14,256. Contract awarded to Basich Bros., Torrance, $12,-167.50.

RIVERSIDE COUNTY—At Temecula River about 8 miles north of San Diego county line, const. tim. br. with conc. deck and gr. and apply rd. mix. surf. trmt. District VIII, Route 78, Section B. V. R. Dennis Const. Co., San Diego, $34,823; B. G. Carrol, San Diego, $34,506. Contract awarded to C. F. Robbins, Los Angeles, $29,694.

RIVERSIDE COUNTY — Between 1½ miles north of Moreno and 2½ miles west of Beaumont, about 6.8 miles in length, seal coat to be applied. District VIII, Route 19, Section D. A. S. Vinnell Co., Los Angeles, $5,935; Matich Bros., Elsinore, $5,766; Oswald Bros., Los Angeles, $5,960; Geo. Gardner & Sons, Redlands, $5,581. Contract awarded to R. E. Hazard & Sons, San Diego, $5,576.

SAN BERNARDINO COUNTY—Between San Bernardino and Highland, about 3.8 miles in length, liquid asphalt, SC-2 to be furnished and applied to the shoulders. District VIII, Route 190, Section C. Regal Oil Co., Long Beach, $1,176; Gilmore Oil Co., Los Angeles, $1,148; Paulsen & March, Inc., Los Angeles, $1,138; Lambs Transfer Co., Long Beach, $1,204. Contract awarded to Morgan Bros., Huntington Park, $1,-080.75.

SAN BERNARDINO COUNTY—Between Verdemont and 0.8 mile westerly about 0.8 mile to be graded and surfaced with pl. mix. surf. District VIII, Route 31, Sec. tion A. Matich Bros., Elsinore, $16,482. Contract awarded to George Herz & Co., San Bernardino, $15,033.20.

SAN BERNARDINO COUNTY—Between 2½ miles west and ½ mile east of Java, 2.8 miles to be graded and treated with liquid asphalt and construct timber pile trestle. District VIII, Route 58, Section N. Matich Bros., Elsinore, $49,927; Miracle Co., San Diego, $44,738. Contract awarded to Basich Bros., Torrance, $44,243.70.

SAN DIEGO COUNTY—Between Lake Hodges and Escondido, 3.6 miles to be graded and surfaced with plant-mix surfacing. District XI, Route 77, Section B. Daley Corporation, San Diego, $88,716; V. R. Dennis Const. Co., San Diego, $83,-381; Basich Bros., Torrance, $92,482. Contract awarded to R. E. Hazard & Sons, San Diego, $86,213.50.

SAN FRANCISCO-OAKLAND BAY BRIDGE—Tile lining Yerba Buena Tunnel of San Francisco-Oakland Bay Bridge. Malott & Peterson, San Francisco, $57,989; American Art Tile Co.-Rigney Tile Co., Oakland, $59,131; Art Tile & Mantel Co., San Francisco, $63,680; Danton-Fratessa, Ltd., San Francisco, $64,691. Contract awarded to Superior Tile Co., Oakland, $55,113.87.

SAN LUIS OBISPO COUNTY—Bridge across Santa Maria River, one-half mile north of Guadalupe to be redecked. District V, Route 56, Section E. R. D. Patterson, Santa Barbara, $15,808; F. C. Stolte Co., Alameda, $15,700. Contract awarded to John Fesler, Santa Maria, $14,480.

SAN LUIS OBISPO COUNTY—At San Juan Creek, about 38 miles east of Santa Margarita, existing bridge to be removed, new steel and timber bridge to be constructed and road approaches to be graded. District V, Route 58, Section C. Contract awarded to F. C. Stolte Co., Alameda, $7,180.

SAN MATEO COUNTY—Between Farrallone City and Rockaway Beach, 5.9 miles to be graded and road-mix surface treatment applied. District IV, Route 56, Section D. Union Paving Co., San Francisco, $393,768; Wood & Bevanda, Stockton, $391,249; Geo. Pollock Co., Sacramento, $361,191; Utah Construction Co. & Paul J. Tyler, San Francisco, $446,143; Lewis Const. Co., Los Angeles, $399,188; Isbell Const. Co., Reno, Nevada, $442,605; A Teichert & Son, Inc., Sacramento, $358,937; D. McDonald, Sacramento, $465,875; Guy F. Atkinson Co., San Francisco, $407,312. Contract awarded to John Carlin, Granfield, Farrar & Carlin, San Francisco, $326,254.

SANTA BARBARA COUNTY—Between Zaca and Los Alamos, about 7.7 miles in length, road-mix surface treatment to be applied to existing shoulders. District V, Route 2, Section C. Oilfields Trucking Co., Bakersfield, $8,872; John Fesler, Santa Maria, $10,918. Contract awarded to A. S. Vinnell Co., Los Angeles, $8,861.60.

SHASTA COUNTY—Between Four Corners and 7 miles northerly. District II, Route 83, Section D-E. Hayward Building Material Co., Hayward, $3,042; L. J. Immel, Berkeley, $3,112.20. Contract awarded

(Continued on page 32)

Predicts Forty Per Cent More Cars on Highways

UPON the extension and improvement of the highway systems of the Nation depends the extent of the expansion of the automobile industry, and to a large degree the prosperity of the country and additional increases in employment.

This is the opinion of C. L. McCuen, president and general manager of a large automobile manufacturing company, as published in the San Francisco Chronicle.

"Our highway program is far behind the program of the automotive industry," he said. "There still remain hundreds of thousands of miles of unpaved roads carrying heavy traffic. There still are narrow roads, dangerous grades, unsafe and narrow bridges, short visibility, unsafe turns, traffic congestion in busy cities, and a thousand and one other highway problems.

IMPROVEMENTS NECESSARY

"In recent years the number of motor vehicles on the Nation's highways has increased tremendously. Great strides have been made during this time in improving our roads. But the number of cars has increased out of all proportion to highway improvements.

"And in the next quarter century our motor vehicles will increase another 40 per cent, if present predictions prove accurate.

"To care for this additional traffic, the cities and states, aided by the Government, must widen and resurface all main traveled roads which do not come up to the standard. They must widen and rebuild curves. They must build an infinitely larger number of railroad grade separations, construct a large number of two-lane roads approaching the larger cities, and rebuild and resurface an enormous number of city streets.

CALL FOR GOOD ROADS

"In cities of large population we must see an increasing construction of overhead highways, eliminating crossings entirely, and effectively speeding up traffic. We must build more and more by-passes. We must do our best to eliminate ditches along the highways.

"In short, there must be a concentrated effort on the part of all public officials to improve country highways and city roads to a point where the growing number of motor vehicles will not mean an increase in accidents or increasing traffic congestion.

"Good roads affect not only the automobile, oil and allied industries. They play a large and important part in the fortunes of the farmers, the manufacturers, and the business men."

German Design for Junctions With Auxiliary Roads

The present design of the German motor roads includes junctions with auxiliary roads at intervals of from 6¼ to 12½ miles. The design of the junction depends upon the importance of the road which crosses the arterial motor road. Where a main road crosses, two curved approach slopes are provided. The motor roads generally consist of two 24-ft. 6 in. roadways separated by a central strip 16 ft. 6. in. wide. A raised island strip 11 ft. 6 in. wide is provided at the outer margin, separating the motor road from an auxiliary roadway 20 ft. wide.

Vehicles about to enter the motor road must proceed for some distance in full sight along the auxiliary roadway. The minimum radius of curvature on the motor roads is 2,625 ft. At the junctions, the minimum radius for exits from motor roads is 164 ft. and for entrances, where traffic is necessarily slower, the minimum radius is 82 ft. These curves have additional widths of 10 ft. for two-way approaches and 5 ft. for one-way approaches. The normal width of the one-way approach (not on curves) is 13-ft. roadway and 5-ft. footway; the two-way approach has a 20-ft. roadway and two 5-ft. footways. The approach gradients are 1 in 40 to 1 in 20, the actual junctions being kept level.—*Road Abstracts 1936.*

Highway Bids and Awards for July, 1936

(Continued from page 31)

to C. F. Fredericksen & Sons, Lower Lake, $2,995.20.

SHASTA COUNTY—Between Shaverley Saw Mill and Montgomery Creek, about 2.5 miles long. To be surfaced with road-mix surfacing. District II, Route 28, Section B. Contract awarded to Lee J. Immel, Berkeley, $10,700.

SISKIYOU COUNTY—Between Grizzly Peak and ¼ mile east of McCloud, about 12.5 miles in length, Class C. Seal Coat. District II, Route 83, Section B. Contract awarded to Hayward Building Material Co., Hayward, $5,139.

TEHAMA COUNTY—Between Route 3 and 1.5 mile east of Dales, about 13.4 miles to be surfaced with crusher run base and plant-mix surfacing (M.C. type). District II, Route 29, Section A. Isbell Construction Company, Reno, Nevada, $178,884; Hemstreet & Bell, Marysville, $185,320; Hanrahan Company, San Francisco, $199,853. Contract awarded to A. Teichert and Son, Inc., Sacramento, $156,780.

VENTURA and LOS ANGELES COUNTIES—Between Somis and 1 mile east of Simi (Ven-9-B,C) and between Castaic Jct. and 2.4 miles west (L.A. 79-A) about 16.2 miles surf. parts with pl. mix surf. and appl. surf. trmt. to shldrs. on portions. District VII, Routes 9, 79 Section A, B, C. Geo. R. Curtis Paving Co., Los Angeles, $76,402; Oswald Bros., Los Angeles, $71,658; Southwest Paving Co., Roscoe, $74,329. Contract awarded to Griffith Co., Los Angeles, $64,348.20.

VENTURA COUNTY—Br. over Conejo Creek, 2.5 miles east of Camarillo, to be widened. District VII, Route 2, Section B. R. R. Bishop, Long Beach, $23,679; Contracting Engrs., Inc., Los Angeles, $28,631; Byerts & Dunn, Los Angeles, $23,911; Sparks & Mundo, Los Angeles, $25,078; J. E. Haddock, Ltd., Pasadena, $27,696; C. F. Rohbins, Los Angeles, $21,061. Contract awarded to Robt. D. Patterson, Santa Barbara $20,868.18.

YOLO COUNTY—Between Woodland and Knights Landing, about 11.38 miles of existing bituminous surfacing to be planed. District III, Route 87, Section A. J. R. Reeves, Sacramento, $7,522; A. Teichert & Son, Inc., Sacramento, $9,690; Hanrahan Co., San Francisco, $16,830. Contract awarded to Asphalt Pavement Planing Co., Oakland, $6,630.

YUBA, COLUSA, SUTTER, YOLO, PLACER, SACRAMENTO COUNTIES—At various locations in District III, 37 miles seal coat to be applied to existing roadbed. District III, Routes 3, 6, 7, 15, 17, 87, 100, Section A, B, C, D. Hayward Building Material Co., Hayward, $18,689; Lee J. Immel, Berkeley, $19,372. Contract awarded to E. A. Forde, San Anselmo, $17,488.89.

GAVIOTA PASS ROAD WIDENED

(Continued from page 30)

the ocean, he may behold the distant Santa Barbara Islands.

Highway construction in Gaviota Gorge originally was performed in 1915 and served adequately until the increase in volume of traffic on the Coast Route, known as U. S. Route 101, demanded reconstruction. This was completed during October, 1931.

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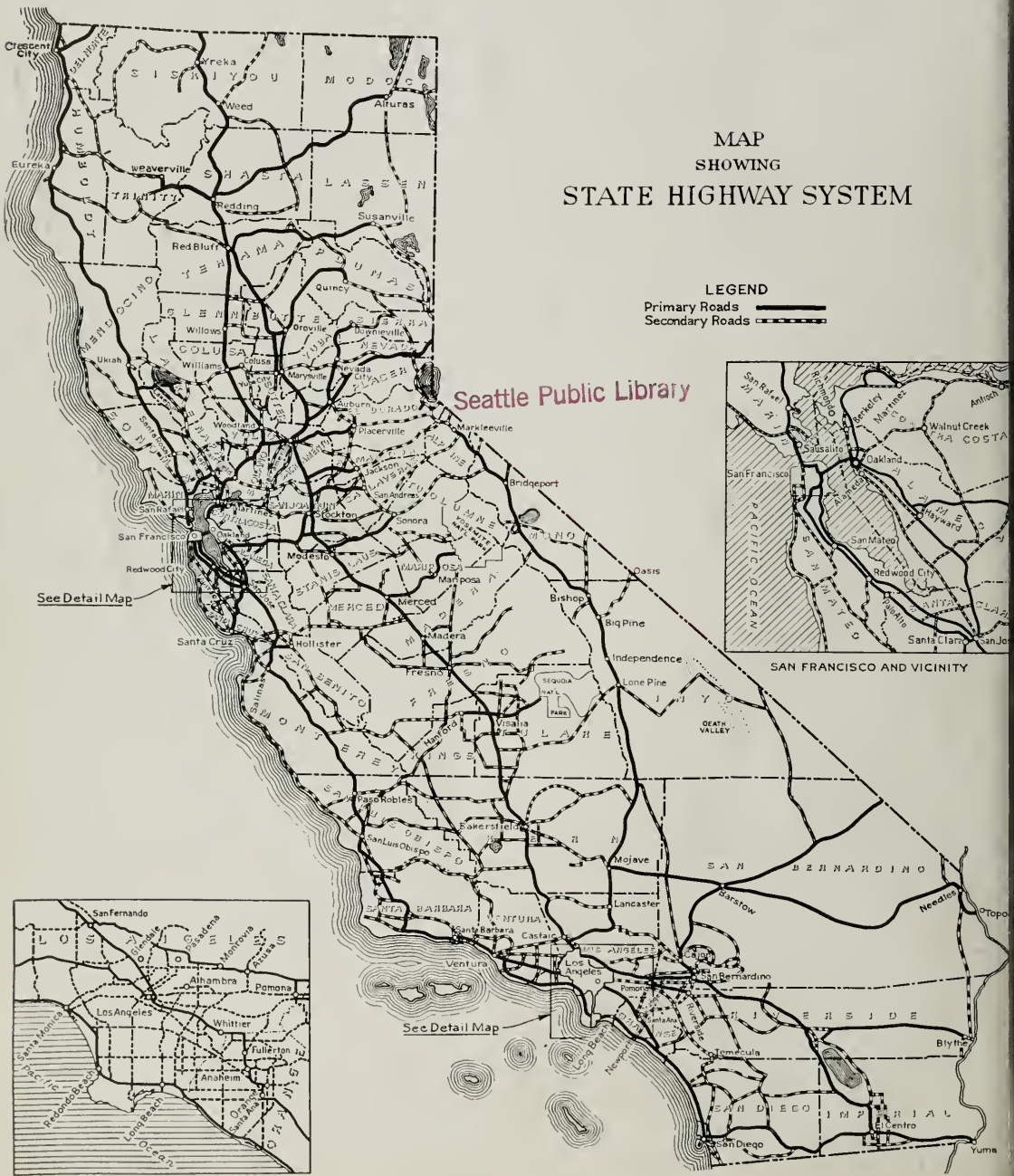
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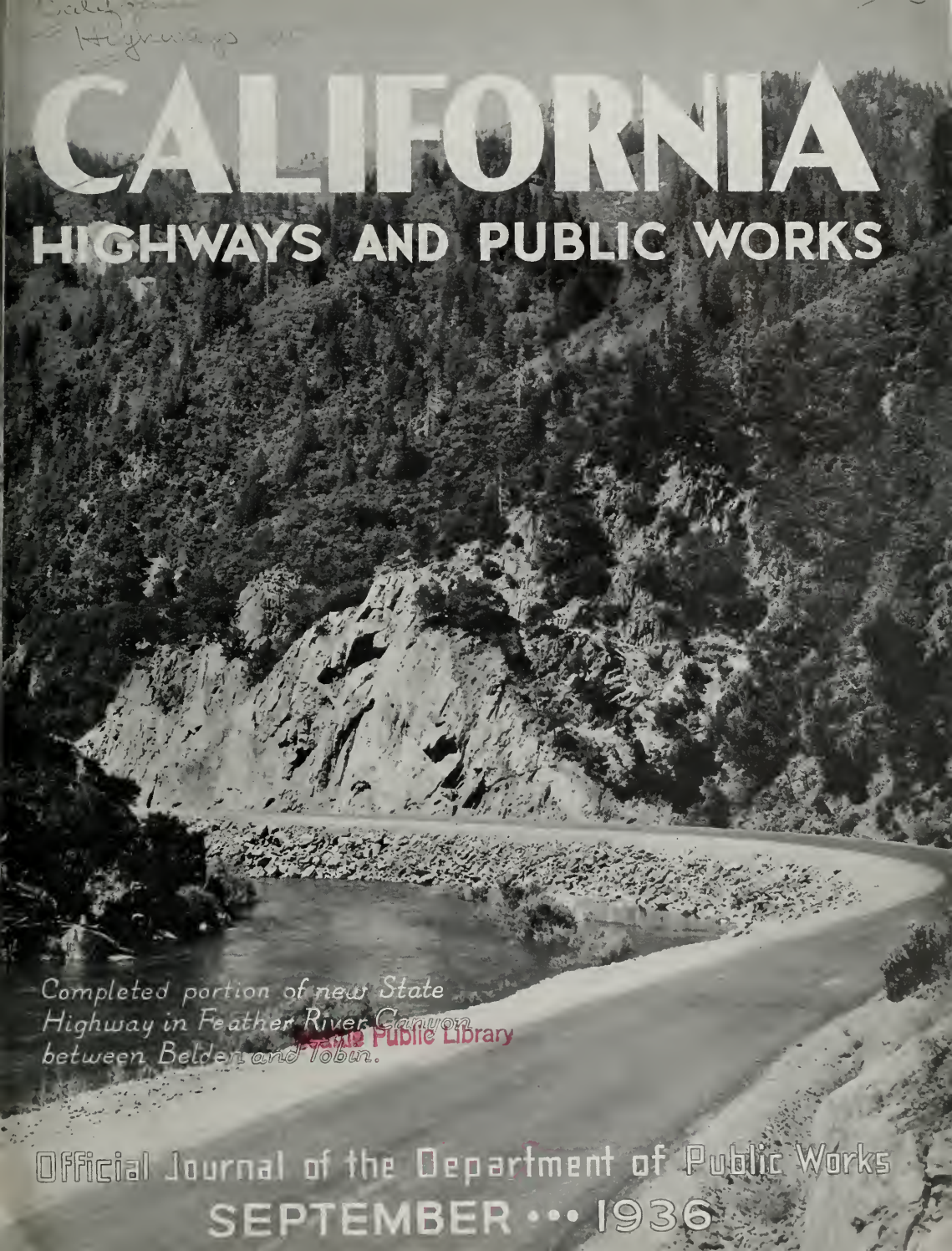
LEGEND
Primary Roads
Secondary Roads



SAN FRANCISCO AND VICINITY

LOS ANGELES AND VICINITY

CALIFORNIA
HIGHWAYS AND PUBLIC WORKS



Completed portion of new State Highway in Feather River Canyon between Belden and Tobin.

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Official Journal of the Department of Public Works

SEPTEMBER ••• 1936

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways of the Department of Public Works, State of California

EARL LEE KELLY, Director C. H. PURCELL, State Highway Engineer JOHN W. HOWE, Editor

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Vol. 14 SEPTEMBER, 1936 No. 9

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400 Projects Improve Traffic Service on 3630 Miles of Highways

By T. H. DENNIS, Maintenance Engineer

AN important feature in the record of accomplishment by the Division of Highways during the current biennium (July 1, 1935-June 30, 1937) will be the number and extent of small improvement projects carried out by maintenance forces and paid for out of regularly budgeted funds.

The extent and value of this work from a travel point of view is not generally realized. During the current biennium some 400 projects have been set up in this program, covering more than 3630 miles of State highway. Many of these projects have been completed and, with very minor exceptions, the remaining ones will be finished by December 1, or earlier.

The prime purpose is to complete the work well in advance of the winter season so that traffic may secure the maximum benefit from the improved highway facilities.

This program of projects is made necessary because under present conditions, the "upkeep and replacement in kind" theory of road maintenance does not meet the road and traffic situation as it exists today in California.

This is mainly due to the fact that a considerable mileage of roads recently added to the State system was constructed either to fill the need of horse-drawn traffic, or, was built before the present volume, speed and weight of traffic could be foreseen or provisions made to accommodate it.

In order to meet the demand and safeguard traffic as well as possible until the time when such sections of roadway can be reconstructed, a fund is provided in the budget setup which may be drawn against to finance relatively small improvement projects.

This work is distinguished from the so-called "minor-improvement" work to the extent that it may be performed on the existing highway alignment even though the eventual location may later require its abandonment.

Likewise, the type of work is developed to best take advantage of the local situation if adherence to recognized practice unduly increases the cost. The test of the projects is traffic need, safety, and reduction in maintenance cost.

This work is programmed under supervision of the Maintenance Engineer and is mainly carried out by the maintenance organization either directly on the day labor projects, or by control of the inspection on portions handled under contract.

The jobs are well distributed throughout the State with projects in each county. Some of the projects extend over considerable distances.

One contract in the Eureka district covers furnishing and stockpiling in windrows of road mix surface material on 21.5 miles of the Redwood Highway, routes 1 and 48 in Mendocino, Humboldt and Del Norte counties. The spreading and compacting of the windrowed material is handled by the maintenance forces.

A second job covers reinforcement of portions and application of penetration dust oil on 32 miles of route 73 between Joseph Creek and New Pine Creek in Modoc County.

Variety of Projects Built Under Maintenance During Biennium

	Miles		Projects where mileage does not apply
	Traveled way	Shoulders	
1. Widening	55	60	--
2. Drainage improvement	--	--	28
3. Bridges (widening, strengthening or replacement	--	--	120
4. Grading and dust oil application	115	--	--
5. Reinforcing	35	--	--
6. Dust oil application	1,200	10	--
7. Reinforcing and sealing	40	4	--
8. Road mix oil treatment	710	500	--
9. Plant mix surfacing	280	123	--
10. Seal coat	285	80	--
11. Nonskid application	80	30	--
12. Road mix oil treatment of beams and gutters	30	--	--
13. Guard rail installation	--	--	1
14. Miscellaneous projects	--	--	5

(Continued on page 9)

Governor Merriam Opens Unique Salinas Underpass

THE Salinas Underpass was opened to traffic on Friday, August 28th, when Governor Frank F. Merriam cut the ribbon and officially dedicated the new structure to highway service.

Governor Merriam, Director of Public Works Earl Lee Kelly and federal, county and city officials attended the dedicatory ceremony and spoke briefly to a large audience.

This subway is located at the north end of the main business district of Salinas in an area of very heavy motor vehicle traffic. North Main Street and Monterey Street intersect at the point of crossing of the Southern Pacific railroad track, forming a wye at the point of intersection.



Dangerous old grade crossing in city of Salinas with a daily average record of 35 rail and 7500 vehicular movements across intersection.

THREE HIGHWAYS CONVERGE

Monterey Street is the State Highway route through Salinas on the Coast Highway from San Francisco to Los Angeles. Over 7500 vehicles pass this location daily. In addition to the local traffic and the main through traffic on the State Highway from Los Angeles to San Francisco, two other important state highways, State Route 117, from Monterey to Salinas and State Route 118 from Watsonville converge at this point and contribute their quota of vehicles from the Monterey Peninsula and coast points.

The former grade crossing at this location was one of the most important crossings on the State Highway System. It was not only dangerous because of the heavy rail and vehicular traffic, but caused serious delay to motor vehicles because of the fact that it is located at the head of the Southern Pacific Company's yard tracks and switching movements are very numerous.

In addition to eight regularly scheduled passenger trains and two freight trains daily there are an average of 25 switching movements over this crossing. Since 1926 there have been 16 accidents which were of such serious nature that railroad equipment was damaged and consequently the accidents were reported to the State Railroad Commission.

TRAFFIC GREATLY DELAYED

The actual vehicle minutes delay due to stops because of passing trains in a 24-hour period was 409—or the equivalent of one car being delayed at the crossing 6 hours and 49 minutes out of the 24-hour period.

The structure is unique in that it is the only one in the state in which two main traveled arteries meet in the depressed portion of a subway and are carried under railroad tracks through the subway structure.

Many complex problems arose in connection with the design and construction which materially added to the cost of the project. Because of the proximity of ground water at this location it was necessary to design the subway against hydrostatic uplift. This was accomplished by providing a heavy waterproofed section of concrete below the roadway area of sufficient weight to offset the floating effect of the ground water.

LAKE STREET RELOCATED

In order to effect a saving in providing against this hydrostatic pressure it was found more economical to raise the railroad track than to lower the street grade a greater distance into the ground water area. Accordingly, the railroad tracks were raised approximately two feet. Because of the raise in elevation of the tracks it became necessary to re-grade and pave adjoining streets to meet the new elevation of the railroad tracks.

(Continued on page 17)



Views of the new Salinas underpass opened by Governor Merriam August 28th. At top, south approach where two arterials separated by triangular parking converge in subway. Below, the north approach accomodating traffic from Coast Highway and local street intersection. Official group at ribbon-cutting, left to right, Highway Commissioner H. R. Judah; Assistant Public Works Director Justus Craemer; Miss Muriel Adams; Councilman Wm. Jeffery; Secretary Fred. McCarger, Chamber of Commerce; Governor Frank F. Merriam and Director of Public Works Earl Lee Kelly.

Niles Project Includes Six Grade Separation Structures

By
JNO. H. SKEGGS,
District Engineer

ONE of the outstanding grade separation projects undertaken by the Division of Highways of the Department of Public Works is under way in the town of Niles, Alameda County.

In few localities outside of metropolitan districts are there to be found as many dangerous traffic situations as exist in the small area embraeing this project.

The entire project consists of six grade separation structures, a concrete bridge 430 feet long, minor structures and nearly three miles of grading, paving and surfaeing. A contract for the construction work in the sum of $453,169.82 has been awarded. The State's share of the entire improvement, including costs of detours and other necessary expenditures, will amount to approximately $611,000.

An important feature of this grade improvement to the highway and railroad facilities in Niles will be the construction of a new high standard reinforeed eoncrete bridge over Alameda Creek to replace the present inadequate old structure which would, in any case, have required reconstruction in the very near future.

HAZARDOUS GRADE CROSSINGS

Niles is situated at the lower end of Niles Canyon about 23 miles southeast of the eity of Oakland. The trunk lines of the Southern Pacific Railroad and the Western Pacific Railroad enter the canyon at Niles and other branches and spurs of both rail systems join there the main trunk lines.

A primary State highway, Route 5, passes through the town and has junction with the former county road known as "Niles Canyon Road," entering Niles from the east, and with the county road from Newark and Centerville, known as the "Centerville Road," approaching Niles from the west.

These county roads were taken into the State highway system in 1933 by legislative act. They now are parts of Route 107.

Route 5 is the main highway eonneeting East Bay metropolitan districts with territories and cities to the south and at Niles its traffic is largely increased by reason of junction with Route 107, bringing eonnections to territories east and west.

Up to the present time, this traffie has had to run the gauntlet of five rail and highway grade crossings on the State highways through Niles and one grade erossing on a county road — all of whieh crossings now are in process of elimination by relocation and construction of approximately three miles of new road in the vicinity of the town of Niles.

The new location is on high standards. On Route 5 it leaves the present highway where that road turns to underpass the Southern Pacific Railroad at the westerly entranee to Niles, and traverses the northerly outskirts of the town to underpass sueeessively the Southern Pacifie main line, the Western Pacific main line, and the Western Pacific San Jose branch.

SIX NEW STRUCTURES PLANNED

Reconstruction on Route 107 for the Niles Canyon connection replaces the present dangerously low and narrow subway of the Southern Pacific San Jose branch with a suitable standard structure which is approached on straight alignment.

For Route 107 (Centerville eonnection to Route 5) the new construction is on good alignment and provides two underpasses, one for the Southern Paeific branch to San Jose and one for the wye eonnection between the Southern Pacific branch roads to Centerville and to San Jose.

This improvement, therefore, includes six new structures underpassing railroads whereby traffic on Route 5 will be accommodated with provision for four lanes of traffic and on Route 107 there will be two lanes.

In addition to the subways, the project includes the major structure bridging Alameda Creek, which will be a reinforced concrete bridge, 430 feet long, 44 feet clear width between curbs, with a 5-foot sidewalk on each side.

All of the structures carry ample sidewalk provisions for pedestrians.

The new highway construction connecting these important structures will be built to a standard width of 56 feet on Route 5 and 36 feet on Route 107. For Route 5 a total of 2417 feet of the new grade will be paved with Portland eement concrete 40 feet wide. The balanee of Route 5, about 9540 feet, will be surfaced with bituminous treated stone sereenings, plant mixed, to a width of 31 feet, excepting where it is widened to 40 feet over the section approaching and leaving the Twin subways under the Western Pacific San Jose braneh.

The 31-foot plant mix surfaeing will be constructed 21 feet on one side of the center line and 10 feet on the other, so that the additional 10 feet to make a 40-foot width ean be readily made when required to accommodate traffic needs.

On Route 107 the surfacing will be to a width of 22 feet and consist of bituminous treated crushed rock screenings, plant mixed. All pavement and surfaeing will be placed upon crusher run base resting on select material in cuts and embankments.

SEPARATED TRAFFIC LANES

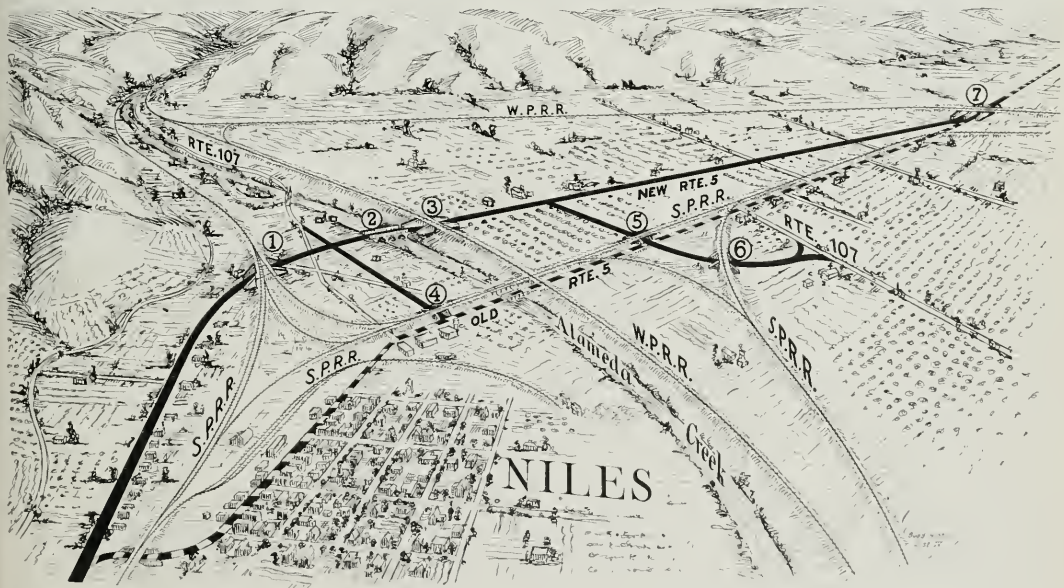
On Route 5 the new alignment is adapted to salvage the existing narrow two-way underpass of the San Jose branch of the Western Pacific, and this improvement is designed to carry southbound traffic only through the present subway. A new structure will be built adjacent to the existing one to provide for the northbound traffic. These two separated lanes of traffic will be marked by a curbed dividing strip extending several hundred feet on both sides approaching the subways.

The entire improvement will be financed by Federal allotments from the Works Progress Administration funds under the Emergency Unemployment Relief Act of 1935.

Elimination from the Niles area of congested major traffie hazards is the objective of this project, considered by the Department of Public Works to be one of the most important grade separation improvements it ever has undertaken.



View of Niles area in Alameda County where an extensive grade separation program is under way consisting of six underpasses, a concrete bridge and the relocation of approximately 3 miles of State Route 5, the Santa Cruz-Oakland-Stockton highway as shown by white dotted line.



Sketch map by Bud Hinton, draftsman-delineator of District IV, showing details of Niles grade separation and relocation project as follows: 1—Southern Pacific main line underpass for relocated Route 5 indicated by heavy black line. 2—Concrete bridge over Alameda Creek. 3—Western Pacific main line underpass. 4—Southern Pacific-San Jose branch underpass for Niles Canyon road. 5-6—Underpasses beneath Southern Pacific for State Highway 107 connection to Centerville. 7—Underpass of Western Pacific branch to San Jose. Dotted line shows present State Highway Route 5.

Paving American Canyon Cut-off With Concrete Mix

By R. E. PIERCE
District Engineer

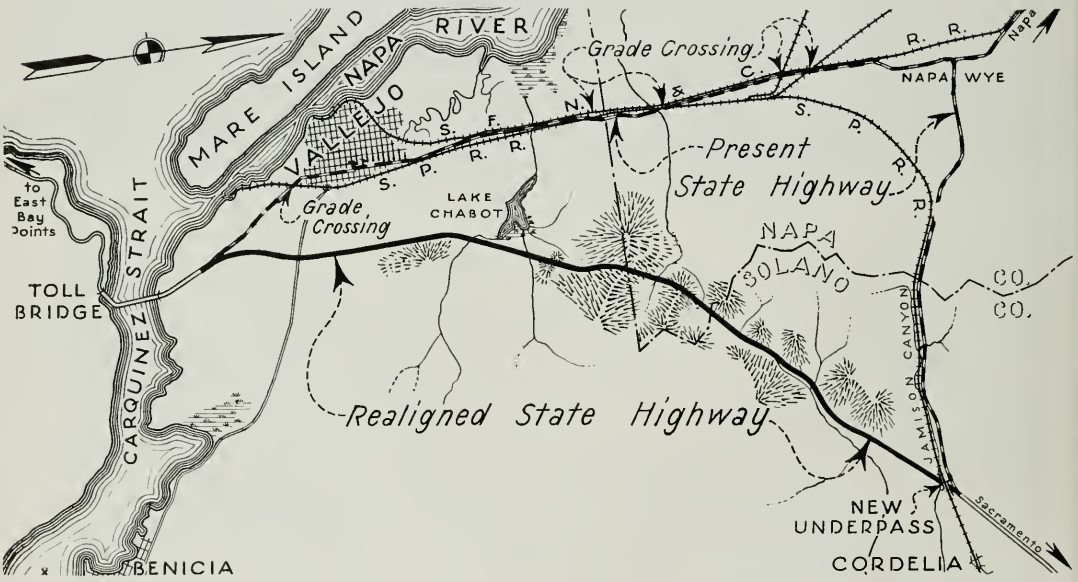
CONCEIVED as a major highway project almost two decades ago, originally surveyed by the State in 1926, the American Canyon cut-off, on which the first shovelful of earth was turned by the contractor on October 9, 1933, is rapidly approaching completion. The present paving contract is expected to be finished by the end of November.

This project, involving roadway excavation of more than 1,475,000 cubic yards of material and difficult three traffic lanes and 9.8 miles of 20-foot, two-lane pavement from the Benicia Road to the junction of Route 8 west of Cordelia has been completed.

The project provides modern standards with minimum radius curves of 2500 feet, and 6% maximum grades. The grading, drainage, etc., on this project was completed during 1934 at a cost of $507,376. One cut on the project, about 2400 feet long, involved the excavation of 650,000

vember 16, 1935, a contract in the sum of $434,429 was awarded to the lowest of eight bidders for application of a seal coat, placing selected material insulating course and paving with Class "B" Portland cement concrete. Contingencies and supplemental work will bring the estimated cost of the paving project to approximately $467,000.

Extensive work marked the preparation of the roadway for paving, involving the placing of 143,000 cubic



Map of realigned State Highway through American Canyon, saving approximately six miles between Sacramento and San Francisco.

grading, will effect a saving of approximately six miles between Sacramento and San Francisco and will eliminate five railroad grade crossings on the present state highway route via Jameson Canyon to the Napa Wye and thence along narrow, congested city streets of Vallejo.

Concrete pavement operations are well under way. Laying of a Class "B" Portland cement concrete pavement, 30 feet in width, from a point about a mile east of the Carquinez bridge to the Benicia Road, a distance of approximately 1.4 miles, providing

cubic yards of material and has a maximum depth of 130 feet.

The major fill on this project is approximately 2500 feet in length and approximately 80 feet high, and involves about 900,000 cubic yards of material. This fill is broken in the center by a timber trestle on concrete abutments.

Sufficient time having been allowed for consolidation of the foundation material on the heavy fills, the Department of Public Works called for bids on November 13, 1935, for the paving of the new highway. On No-

yards of selected material, which was spread on subgrade 1 to 1.5 feet thick for the entire width of the roadway. The subgrade previously was sealed with one-fourth gallon per square yard of SCL-A liquid asphalt and three-eighths gallon per square yard of E grade asphalt.

Work was started on the concrete pavement last July.

Preparation batching and delivery of aggregate to the mixers on the job was handled by the subcontractor, who established a permanent batching

(Continued on page 8)







Paving scenes on the American Canyon cut-off relocation of State Highway No. 7 (U. S. 40) from 1 mile East of Carquinez Bridge to Cordelia. The several views show two pavement mixers operating side by side placing a 20 foot width of Portland cement concrete pavement, together with three mechanical tampers in addition to the necessary hand tamping and finishing equipment. A vibrator is being used from each side of the pavement ahead of the first finishing machine. Inset shows subgrade prepared and ready for paving.



The "Big Fill" of the American Canyon Cut-off showing paving operations under way placing a 20-foot concrete surface.

Paving American Canyon Cut-off With Concrete Mix

(Continued from page 6)

plant on the outskirts of Vallejo. Aggregate was delivered by railroad car, discharged into a track feeder and elevated by belt conveyor to the steel bunkers. The steel bins had a combined capacity of about 400 tons of aggregate. A shuttle belt along the tops of the bins provided for distributing the various grades of aggregate into the separate bins.

Aggregates were batched with weighing equipment operated automatically to prepare a 1 cubic yard batch. This entire batching sequence operates by one lever on the control board, and does not require any attention except for a change in the mix. Trucks load under the central batching hopper.

Under the paving procedure followed by the contractor on this job, A fleet of 25 to 30 trucks hauls the combined aggregate to the mixers. Subgrade preparation, placing of timber headers, and other work preliminary to paving, follows the usual standard practice.

Two mixers operate side by side on the 20-foot pavement, while on the 10-foot width, the two mixers operated in tandem. They are supplied by the aggregate trucks backing into position and dumping directly into the skips of the mixers. Mixing water is supplied through hose from a welded steel line laid along the length of the job. Sacked cement is in position along the sides of the headers, ready to be emptied into the mixer skips. Between the mixers and the discharge from the buckets, the reinforcing steel, both transverse and longitudinal, is placed by a special steel crew.

FINISHING PROCEDURE

Immediately behind the mixers, a finisher with double screed carries out the first step in the finishing process. Mounted on the forward end of this machine are two gas driven concrete vibrators which are used continually in vibrating the concrete mass ahead of the first screed. Behind this first unit, a finisher machine operates to provide a second stage of the finishing process.

Some distance to the rear, a third finishing machine, with single screed, carries a small wave of grout for the final machine finishing operation. Behind the screed, this machine carries a groover which cuts a 2-inch mark along the longitudinal center line of the paving, and the machine operator places 10-foot lengths of steel reinforcing bar in this groove, to a depth of about 2 inches, as the machine progresses. Immediately behind the machine, two men using heavy transverse markers prepare a groove to a depth of somewhat over 2 inches, into which is inserted the ¼ x 2 inch steel strips, at the transverse weakened-plane joints.

The next finishing operation is the longitudinal tamping float, operated from timber bridges. Following this is a crew of men operating transverse (bull) floats, followed by the finishers. In this last step, the steel at the weakened-plane joints is removed, and the reinforcing bar along the center line is also taken up, leaving a weakened-plane along the center of the slab. Following the last finishing step, the concrete placed during the day is kept sprinkled, and the next day covered with dirt, and water-cured in the usual manner.

EXPANSION JOINTS

On this project, ¾-inch expansion joints were provided at 100-foot intervals with dummy joints at the intervening 20-foot intervals. The paving design provided for a weakened plane along the center line with 4-foot lengths of steel reinforcing tie-bars or tie-bolts spaced at 4-foot intervals supported on steel chairs on the subgrade. The pavement section for the 20-foot slab was 0.55 foot thick at the center, increasing to 0.75 foot at the edges in a distance of 2 feet.

Mr. A. N. Lund was the Resident Engineer in charge of the work for the State.

An old darky was sent to the hospital, and one of the nurses put a thermometer in his mouth, to take his temperature. Presently, when the doctor made his rounds, he asked:

"Well, Mose, have you had any nourishment?"

"A lady done gimme a piece of glass to suck on, boss, but I'se still pow'ful hungry."

400 PROJECTS IMPROVE TRAFFIC SERVICE

(Continued from page 1)

A third project covers placing a one-foot strip of plant mix material along pavement edges at various locations over a distance of 79 miles on route 2, the Coast Highway, in Santa Barbara and San Luis Obispo counties.

Some fifty of the projects are fair sized contracts, but most of them range from a few hundred dollars up to about $20,000. Funds are allocated north and south to primary and secondary routes in accordance with legal requirements.

BRIDGE STRUCTURES STRENGTHENED

The work outlined is not necessarily continuous for a given project. The widening work, for example, may consist simply of power shovel work at locations where the road width is restricted, sight distance too short or drainage poor. The excavated material is used to widen out embankments, etc., or the work may be done entirely with tractors, scarifiers and graders, or by importing material.

The drainage improvement may provide needed culvert pipe for cross drains or for the extension or deepening of the drainage ditches, cleaning of stream channels, etc.

There are some 250 bridges on the State system which are posted for a restricted load limit. Except for the work done through this improvement fund, many more structures would have a similar restriction. The replacement of bridges is expensive, and the type of improvement covered by this program can only care for relatively small widening, strengthening or replacement work.

Each project, however, increases the service value of the road to that particular community and frequently safeguards against a very real hazard.

ROAD SURFACING RESTORED

The surface treatments on both traveled way and shoulders are on sections where the existing surface has reached the end of its economic life. Usually it was inadequate when originally constructed and to replace it in kind would be expensive and of short benefit.

With the opportunity to widen the section, rework the surface and place additional material or change the type, a distinct improvement can frequently be secured at comparatively small cost which will materially reduce the annual expenditure and provide an adequate service for a number of years.

At the end of the service life, if funds are not available for reconstruction, the surface can then be properly renewed in kind as an upkeep charge.

TRAFFIC SHOWS INCREASE

Traffic counts taken during 1935 and 1936 indicate that the slackening of traffic volume during the depression years has been fully overcome. The volume of traffic on the roads today is practically the same as would have been the case if the normal estimated six per cent increase per year had continued from 1929 to date.

Work of the kind described above is essential to fill the need on a large number of roads until major construction or reconstruction can be financed.

The work is particularly adaptable to the maintenance organization. For small projects experienced men and the necessary equipment are on the ground and there is practically no expenditure required for moving to or from the job, nor slack to take up in organizing a crew.

On projects of sufficient size to justify preparation for and handling by contract, the intimate knowledge possessed by the maintenance forces of sections where failures require excessive maintenance of the soil and local material situation, is applied to good advantage.

TIME ELEMENT FIGURES

It is the general policy of the Division to advertise for contract all work which can be so handled to advantage and particularly work requiring special or heavy equipment. Naturally, the time element has a bearing on such decisions as at least one months' extra time as compared to day labor, is required to get work under way by contract due to detail and legal restrictions. Even when the work is handled by day labor the contractors are benefited through the opportunities offered in rental of their idle equipment.

Under existing conditions it appears that continuation of improvement work of the character now under way will be an essential part of the highway program for some time to come.

SAVED ACCIDENT VICTIMS

Superintendent T. W. Martin, District VII, tells of an automobile accident which might have resulted in fatalities had it not been for prompt work on the part of Foreman C. J. Ward and members of his maintenance crew.

"Ward, with several men, was patching the pavement on LA-62-B when he noticed rising dust on the slope of the road high above him. When the dust settled he saw an overturned car on the slope. He sped to the scene with two of his men and found two seriously injured women imprisoned in the wreck of their machine, which had gone over the grade. Using a cushion of the auto, Ward and his helpers carried the victims up to the road, a very difficult task. The women were rushed to a doctor. Both had suffered numerous bone fractures and other injuries and doubtless would have succumbed but for the quick work of Foreman Ward."

Village Prefers Bad Road

Flint Hill, little village in Rappahannock county, Virginia, wants bad roads, says a news dispatch. A delegation from the village visited Richmond to protest plans to route a modern highway through the town.

"A good road would menace our school children," the delegation told Governor George C. Peery. "Can't you arrange to run the road west of Flint Hill?"

"That means fight where I come from!"
"Well, why don't you fight then?"
"'Cause I ain't where I come from."
—*Williams Purple Cow.*

Sandy joined a golf club and was told by the professional that if his name was on his golf balls and they were lost, they would be returned to him when found.

"Good," said the Scot, "put my name on this ball."

The pro did so.

"Would you also put M.D. after it?" said the new member. "I'm a doctor."

The pro obeyed.

"There's just one more thing," went on the Scot. "Can ye squeeze 'Hours 10 to 3' on as well?"



Two bridges and a system of four spacious ramp connections feature the extensive construction project separating the grades of the prin shows grading for the east ramp to the 3150 foot overhead alignment, and the new bridges over Coast Highway and Newport Channel.

NEWPORT GRADE SEPARATION TO ELIMINATE

By L. R. McNEELY, Resident Engineer

ONE of the most important and, from an engineering standpoint, one of the most interesting, grade separation projects undertaken by the Division of Highways is nearing completion at Newport Beach.

No railroad crossing is involved. The separation is for highway traffic only. It is between the Newport-Santa Ana Road and the Coast Highway, State Route 60, and is designed to relieve traffic congestion that in recent years has become increasingly heavy and hazardous.

The Newport-Santa Ana Road is the main highway to the beach communities of Newport and Balboa. During the summer season week-end traffic has been congested at the intersection of the Newport-Santa Ana Road and the Coast Highway to such an extent that automobiles frequently have been held up for an hour or more in negotiating the intersection.

RAILROAD LINE ABANDONED

Work on the project was started on November 12, 1935. For thirteen years prior to this time the Coast Highway passed under the Southern Pacific railroad line at Newport Beach. Eight years ago it was proposed that the Newport-Santa Ana Road, then a county highway, intersecting the Coast Highway at Newport Beach, be lifted up to the level of the railroad viaduct and carried over the State highway.

This proposal was presented to the Southern Pacific Company and it developed that the corporation desired to abandon its Newport Beach line, some eight miles of trackage. After many, many months of negotiations, during which the Newport-Santa Ana Road was taken into the state highway system, the Division of Highways acquired for the State of California the abandoned Southern Pacific right of way and the realigned Newport-Santa Ana Road now occupies the old railroad right of way which carries it over the Coast Highway.

NEW VIADUCT BUILT

The original railroad bridge over the Coast Highway was removed and replaced by a viaduct which provides an underpass for the state highway and an overhead crossing for the Newport-Santa Ana Road.

The new overhead alignment is 3150 feet in length and is connected with the Coast Highway by four ramps, three of which are new construction and one of which is the existing Newport-Santa Ana Road. The connecting ramps will carry two-way traffic with right turns only into the main line traffic.

Overhead construction will be surfaced with 40 feet of Portland cement pavement, with connections to existing pavements surfaced with asphaltic concrete. The ramps will be surfaced with Portland cement concrete pavement from 20 to 24 feet in width. Grading of the overhead has been completed.

Two bridges are being constructed, one carrying the Newport-Santa Ana Road over the present Newport channel consisting of 5 spans and 200 feet in length, and one over the Coast Highway consisting of 3 spans and 158 feet in length.

The Newport channel bridge has one removable span to comply with federal regulations governing navigable streams. Clear distance between curbs on the Coast Highway will be 64 feet. The bridge widths on the overhead are 44 feet between curbs.

A system of side road ramp connections will permit of a free flow of traffic in all directions whatever the destination may be of vehicles coming into the grade separation.

OLD UNDERPASS FLOODED

Work on the Coast Highway includes bringing the existing underpass to grade. The old underpass was drained by gravity into the Newport channel. The gravity drain was supplemented with a two-inch centrifugal pump. Storms sometimes occurred during high tide when there was some difficulty in keeping the sump clear for traffic.

The roadway will be surfaced with asphaltic concrete 40 feet in width.

A lighting system consisting of 32 standards will be included in the project, six lights being installed on each bridge.



Highway and the secondary Santa Ana-Newport Highway at Newport Beach, a badly congested intersection. This construction scene arrow marks location of latter bridge which is 200 feet long and has a movable span to comply with Federal navigation regulations.

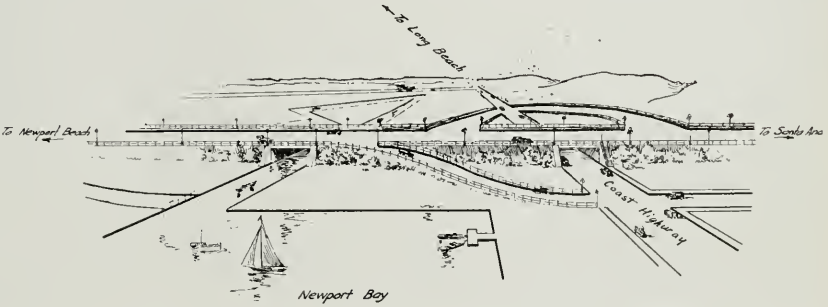
TRAFFIC BOTTLENECK ON COAST HIGHWAY

The slopes of the cuts and fill sections will be planted immediately after completion.

It is expected the entire project will be completed by the end of October. The estimated cost, including the highway overhead bridge, the channel bridge, all ramp connections and incidental work, is approximately $170,000.

While this grade separation undertaking is not a costly one, it is considered important because of the large volume of traffic it will facilitate. Congestion of cars at the intersection has proved nerve-racking to motorists meeting there. Accidents have been frequent and numerous.

During the long delay in the start of construction pending negotiations with the Southern Pacific Company, Division of Highways engineers and other authorities on road building devoted themselves to exhaustive studies of the most modern methods of handling the problem presented. The result is that this grade crossing for highway traffic only is being constructed along the most up-to-date engineering lines, based upon study which would not have been possible had it been necessary to rush the project to completion.



Sketch showing ramp and overhead structure features of grade separation project on Coast Highway at Newport Beach.

Plans for State Highway Officials' Convention

ANNOUNCEMENT has been made by W. C. Markham, executive secretary of the American Association of State Highway Officials, of the appointment of Frank C. Balfour, Supervising Right of Way Agent of the State Division of Highways in Los Angeles, as director of enrollment and entertainment for the twenty-second annual convention of the association to be held in San Francisco December 7th-9th.

All members of the association are requested to expedite the opening of the convention by pre-enrolling with Mr. Balfour, who will make his headquarters at 500 Sansome street, San Francisco. All who plan to attend the December sessions of the association are urged to forward their names to Mr. Balfour together with the names of the women and children who will accompany them.

The complete program for the convention will be published in the November issue of CALIFORNIA HIGHWAYS AND PUBLIC WORKS.

A feature of the program for Tuesday, December 8th, will be an illustrated address concerning the construction of the $77,000,000 San Francisco-Oakland Bay Bridge by State Highway Engineer C. H. Purcell, who has directed the building of this monumental structure for the Department of Public Works. Mr. Purcell will describe in detail the work of constructing the bridge.

REFLECTORIZED PAVEMENT BUTTONS AN AID TO NIGHT DRIVING

By F. M. CARTER, Assistant Maintenance Engineer

EXPERIMENTAL installations of reflectorized pavement buttons have recently been installed by the Maintenance Department of the Division of Highways, marking the center line at dangerous locations on our highways, as an aid to safe night driving.

To determine whether these markers are efficient, economical, and a preventive of accidents, is a problem that is now being worked out.

First of all, we assume that if these markers do tend to reduce accidents, their use should be consistent. They should be positioned only on dangerous curves and locations where a known hazard exists.

RESTRICTED USE DESIRABLE

Experience with our traffic signs proves that the motoring public disregards such installations if used promiscuously and without definite necessity. An indiscriminate use of reflectorized pavement markers placed on straight stretches of highways will destroy their usefulness.

If these markers are positioned on straight stretches of streets or highways, it is evident that they will not return the same impression to the approaching motorist at hazardous curves.

UNIFORM SIGN POLICY

Our motoring public of today is not to be fooled or bluffed. In our new policy of signing, we have a definite position for each sign to give the same meaning wherever placed. Being uniform in position, shape, and color the motorist is learning that these signs mean what they say. We do not permit positioning of signs to bluff or fool the traffic. This policy should also be applied to reflectorized pavement markers, otherwise the benefit derived from their use is minimized.

Before installing these reflectorized pavement markers, this department conducted tests to determine how such markers should be placed, at what locations, how far apart, et cetera. These tests were made on plans in the office and then in the field at night by placing buttons on the pavement and observing their effect.

The results of these tests proved that when placed on sharp curves at certain locations these markers do assist the night driver.

MANY FAVORABLE REPORTS

Why are these markers receiving such favorable efficiency reports?

Most of you remember when the white center stripe was painted on the pavement, all motorists enthused over the assistance given them by such striping, they zealously remained on their side of the center stripe on tangents and around curves. This respect for the white striping is still the same. It has carried through because of its efficiency and consistent positioning

For daylight use there is no comparison between the value of this white line and reflectorized pavement markers because the markers are not as visible even if made of polished metals.

At night when new or when they are maintained properly, the reflector buttons do return a warning message in advance of the curve.

Most of us remember when the curve signs, placed in advance of the sharper curves, were reflectorized. The same enthusiastic comments and reports were received. Do the motoring public see and respect these reflectorized curve signs today? This department thinks they do. These signs are now always the same—their position in advance of the curve, their shape, and appearance.

CONSISTENT CURVE WARNING

When you see a reflectorized curve sign on the highway you know you are approaching a curve that from its design requires a slower speed. With this information correctly and consistently given, the wise motorist slows down and follows the white traffic stripe around the curve.

(Continued on page 24)

Governor Merriam Urges More "Road Eyes" for Safety

August 20, 1936.

Hon. Earl Lee Kelly,
Director of Public Works,
Sacramento, California.

Dear Director Kelly:

In driving over the California highways, I have noticed recently that the center of the road on many curves and tunnels is marked with what appears to be an illuminated button or "eye." I am so greatly impressed with this device and its value in outlining the center of the highway for motorists, that I want to indorse its installation, and compliment the Public Works Department upon its good judgment in equipping the highways on curves with this reflector device.

The State should furnish every safety against reckless driving, and make the highways safe for motorists. Definitely marking the middle of the road with the white lines, and hazardous places with these "eyes," which stare at the driver, afford the greatest degree of warning yet devised. Speed the day when all parts of the highway, old and new construction, shall be so equipped.

It seems to me these installations are fully justified in the interest of safety, and in an effort to reduce automobile accidents.

Cordially yours,

(Signed)

FRANK F. MERRIAM,
Governor of California.



This night photograph illustrates how the line of reflectorized buttons or "road eyes" guides the motorist safely through an illuminated underpass in the center of an "S" curve that suddenly looms through the darkness as a brilliant patch of light.



Day photograph of the underpass pictured above shows a wealth of shrubbery and trees on the side slopes presenting a most pleasing arboreal setting as a result of the landscaping of the curved highway approaches over which traffic is guided by the center white line.



Types of reflectorized road buttons with which the Division of Highways is experimenting to test durability, visibility and maintenance cost. Replacement of buttons smashed or dislodged by heavy traffic and necessity for frequent removal of dust and mud accumulations are factors.

Laboratory Develops An Improved Joint Filler

By
THOS. E. STANTON, Jr.
Materials and Research
Engineer

JUST as the mightiest mountains are gradually leveled to the plains, all the works of man are doomed to eventual disintegration if not protected from the elements. Man is therefore constantly battling with nature to preserve what he has built. It may be a battle against chemical disintegration from rain or from running water containing alkalis or acids, or a fight against physical disintegration through the same elements or through alternations of heat and cold, or the impact of forces.

Structures expand with heat and contract with cold, swell when wet and shrink when dry. These alternations of temperature and moisture ultimately spell failure when the structure is under restraint against movement. Hence, we have bursting water pipes in freezing weather and the gradual disintegration of rock mountains with the alternate freezing and thawing of the moisture in cracks and bedding planes.

JOINTS TAKE UP STRESSES

So a pavement or bridge expands when hot or moist and contracts when cold or dry. Stresses resulting from these forces ultimately rupture the structure unless relieved in some way. For this reason all structures of any magnitude must be provided with joints permitting contraction and expansion. Concrete pavement slabs are no exception to the general rule and it is therefore customary to provide planes of weakness across the pavement at regular intervals, ranging from 20 to 30 feet, to insure the formation of shrinkage cracks in a uniform rather than haphazard and irregular manner. In addition to providing for shrinkage, openings from $\frac{1}{2}$ inch to $\frac{3}{4}$ inch wide are left across the slabs at intervals of 60 to 100 feet to permit expansion.

Failure to provide such expansion joints or an insufficient number sometimes causes blow-ups such as are frequently experienced following an extremely hot spell, particularly when the hot spell is immediately preceded by rains which have caused a swelling or expansion of the concrete from moisture.

LEAKAGE SATURATES SUBGRADE

Unfortunately, however, the only cheap and practicable step to avoid destruction by relieving expansion and contraction stresses carries with it new elements of destruction. Concrete without cracks is practically impervious to moisture. However, as soon as cracks form, whether natural or artificial, a channel is provided for ready leakage of water through the pavement and into the subgrade.

Most soils when wet expand and then shrink on drying. While it is true that a partial solution of this difficulty lies in the use of subgrade soils with little or no swell, nevertheless, it is impracticable to entirely avoid this difficulty. Leakage saturates the subgrade adjacent to the crack thereby either causing the foundation to swell, or weakening its bearing power to such an extent that destruction frequently results under heavy traffic.

Moisture on the under side of the slab causes an expansion of that side greater than of the surface exposed to the atmosphere, particularly when dry on a cold day. This results in a warping of the slab and a roughness in riding qualities usually increasing with age. Whether this warping of the slab is the result of swell of the subgrade or unequal expansion of the top and bottom of the slab or any other cause, the results are decidedly objectionable as regards riding qualities and ultimately destructive of the pavement.

QUALIFICATIONS NECESSARY

To overcome these difficulties, highway engineers have for years been endeavoring to develop a crack filler which will effectively seal cracks against leakage. To prevent leakage, the filler must be impervious and must at the same time stick tight to the sides of the concrete. It must be elastic enough not to break away and open up cracks when the concrete shrinks.

Ordinary asphaltic cements have been used extensively for the purpose with indifferent success. If the asphalt is hard enough not to flow out of the joint in hot weather, it is generally so brittle in cold weather, when shrinkage is usually the greatest, as to possess no resilience so that the joint filler breaks away from the sides of the concrete and cracks open up which readily admit rain water. If the bitumen is soft enough to remain resilient and ductile in cold weather, it becomes so fluid as to run out of the cracks in hot weather.

Studies on the subject therefore have largely centered around the development of a product which would be ductile at low temperatures and still sufficiently hard but sticky at high temperatures to retain a bond to the concrete throughout the entire range of climatic conditions and over a period of years, if not permanently.

BITUMIN-RUBBER COMBINATION

Within the last six months a product has been developed by the engineers of this department which appears superior to any product developed in the past. This product is a combination of bitumen and commercial rubber latex.

Unadulterated specially processed rubber products have been used with considerable success in recent years in one form or another but have the disadvantage of being quite expensive, which factor mitigates against their general use unless no equal or superior, and at the same time more economical, substitute is available.

The correct proportions of bitumen to rubber latex, determination of the proper grade of bitumen, and method of manufacture and placing described herein is the result of original research, and the purpose of this article is to outline the general problem, the method of attack, and the results to date.

Essential characteristics are stickiness combined with low flowability at high temperatures and high ductility at low temperatures. This quality in the finished product is determined by the grade of bitumen, the ratio of

rubber latex to bitumen, and method of manufacture.

The product must be fluid enough to be readily placeable under ordinary construction methods and yet not so fluid as to run out of the crack or joint either at the time of construction or during subsequent warm weather.

BEST MIXTURE PERCENTAGES

It was early determined that the best results are secured with a mixture of approximately 70% bitumen of the type used and 30% rubber latex, the quality of the rubber latex being fixed by the grade of material commercially available.

Though the bitumen is heated to between 150° F. and 200° F. at the time of mixing with the latex and the joints poured while still warm, it was found that if anything harder than a comparatively soft grade of asphalt road oil, such as SC4, was used, the mixture stiffened during mixing to such an extent that it was not readily workable with ordinary hand placing methods.

The mix adopted as a tentative standard therefore, consists of 70% SC4 oil and 30% rubber latex, although further studies are being made with cutback 90–95 road oil and E Grade asphalts. Mixing temperatures must be maintained at 200° F. or less in order to avoid foaming of the rubber latex which is an emulsion of water and rubber.

CAN NOT BE REHEATED

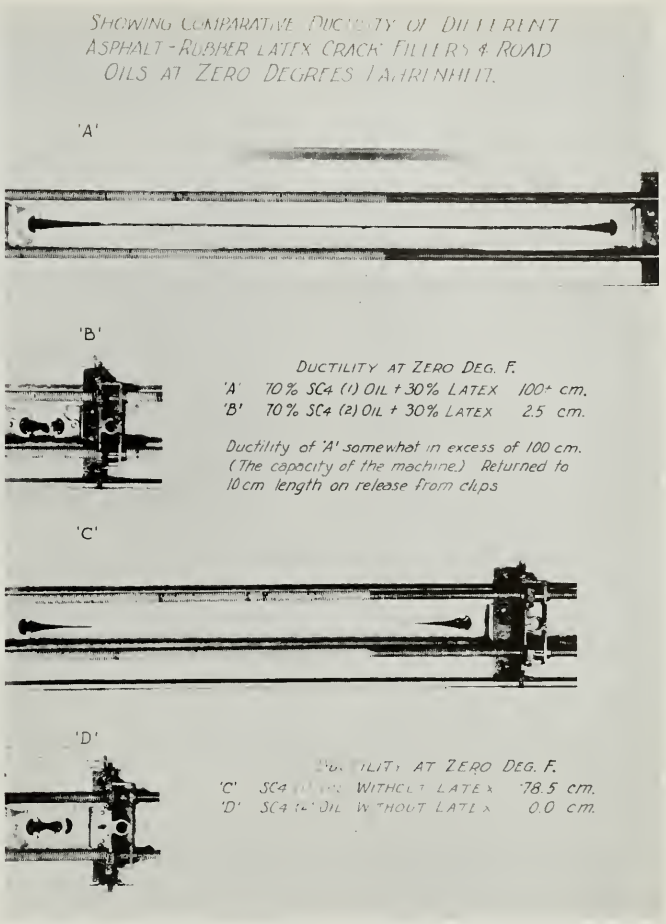
If the joint is to be placed by hand, the mixing must be done on the job and the joints poured while the mixture is still warm and of a workable consistency. It is impossible to subsequently soften by reheating a mixture which has been allowed to cool and harden before use.

The development of air pressure methods of placement may obviate this difficulty and permit the use of a tougher and stiffer hot or cold product.

This, however, is considered a refinement and improvement rather than a necessity, as success has been had with the product and method of placing developed to date.

Several grades of SC4 oil were tried and it was found that the grade, source of supply or method of refinement plays quite an important part. The first oil used gave excellent results. The product was sticky and ductile and yet showed little or no tendency to flow after placing. The next batch manufactured with oil of exactly the same grade but from a different source flowed to an undesirable extent when placed at a workable consistency. A study of the two grades of oil developed the fact that the oil which gave success was quite sticky and ductile at low temperatures and at the same time did not develop objectionable fluidity at high temperatures, whereas the oil from the second source was much less ductile at low temparatures.

As the superior oil is readily obtainable, specifications have been built around this particular grade of oil which it is believed is the result of manufacturing processes rather than confined to a crude from any one field, although this phase is also under investigation.



Photographs showing results of comparative ductility tests of different crack filler materials.

A perfect bond and seal is attained at the time of installation and this bond has been maintained on all joints constructed to date, the oldest being five months old.

It is true that no cold or winter weather has been experienced since the first joint was poured and that the situation may be quite different after the first or subsequent winters. Therefore, it would be premature to claim that the problem has been 100% solved. It is evident, however, that we have a joint filler which appears to be superior to any so far developed and that if nothing better offers, a decided advance has been made.

The material was first tried on two old sections of pavement on the out-

skirts of Sacramento where the straight asphalt poured seals had failed. The expansion joints were cleaned to a depth of two inches and the new joint filler poured with such success that arrangements were made to pour a few joints on two new concrete pavement projects, one the Tejon Pass in District VI, and the other the American Canyon in District X, District Engineers Gillis and Pierce cooperating in the test.

FIRST PROCEDURE MODIFIED

The concrete on both jobs was cured with earth and water. It was therefore necessary to place the joint filler shortly after the concrete was poured and before the earth cover was placed. This condition caused certain difficulties on the Tejon Pass Project which necessitated a retrial using a modified procedure. On the first trial water in the cracks remaining from construction affected the stability of the fresh joint material and subsequently the earth covering, spread before the filler had a chance to stiffen, caused a partial displacement, thereby necessitating patching.

On a retest excess water was removed from the joints before pouring and the fresh poured seal was covered with paper strips to prevent displacement while green. This precaution is unnecessary on old projects or new work not covered with earth for curing, such as where the impervious membrane type cure is used. While the crack filler when green does not pick up readily under traffic, nevertheless, a light surface sprinkling with ground cork may be advisable.

COST OF MATERIAL

At $180 per ton for rubber latex (when purchased in quantity) and approximately $10 per ton for the asphalt, the cost of material per ton of mix is as follows:

70% Bitumen by weight at $10 per ton	$7.00
30% Rubber latex by weight at $180 per ton	54.00
	$61.00

This is the cost per ton of crack filler or approximately 24.4 cents per gallon.

If the seal in the expansion joints is poured to a depth of 1½ to 2 inches, approximately a gallon of material will be required for each joint in a 20-foot-wide pavement at a cost of less than twenty-five cents per joint for the material alone.

In from four to six hours one man can readily mix and pour all joints in a day's placement run of twenty-foot pavement at a total average cost of not over forty cents per joint depending, of course, on the progress of the paving. At a combined cost of sixty-five cents per joint for labor and material, the cost per mile for expansion joints spaced 100 feet apart would be $34.32.

The preceding analysis of methods of procedure and cost apply to expansion joints alone, which are usually from ½ inch to ¾ inch wide and re-



Placing improved filler by hand method at combined cost for labor and material of 65 cents per joint.



Close-up of one-man pavement joint filling apparatus.

Table Showing Comparative Ductility of Different Grades of Joint Filler at Low Temperatures

Material	Ductility at 0° F.	Remarks
70% SC4 (No. 1) + 30% Latex	*100 + cm.	Returned 90 cm. on release of clip.
70% SC4 (No. 2) + 30% Latex	2.5 cm.	No appreciable return on breaking.
100% SC4 (No. 1) without Latex	78.5 cm.	No appreciable return on breaking.
100% SC4 (No. 2) without Latex	0.0 cm.	No appreciable return on breaking.

* 100 cm. maximum capacity of ductility machine. Maximum ductility considerably in excess of 100 cm.

quire a different treatment than ordinary shrinkage cracks. In order that the asphalt rubber latex crack filler may flow readily into shrinkage cracks, it has been found necessary to thin the filler with gasoline or other suitable solvent. No difficulty has been experienced in securing good penetration and thorough sealing of the cracks with this fluid material which stiffens as soon as the volatile constituents have evaporated or been absorbed by the concrete.

For crack filler the following combination is used:

70% SC4 cutback with gasoline or other suitable solvent to consistency desired, the desired consistency depending on the width of the cracks.

30% Commercial rubber latex.

In conclusion, it may be stated that a definitely improved crack filler has been developed but time alone will afford the answer relative to its durability and continued serviceability with age.

While cost is an important item, it is relatively unimportant if sufficient service beyond past methods can be secured to justify any added cost and difficulties of installation.

All of the development work on the material described herein was done by Mr. Harry S. Bennett, Asphalt Testing Engineer, and Mr. Robert Gillis, Chemical Testing Engineer, both with the Materials and Research Department.

CORPSE TAKES A WALK

While a lover of dogs, Foreman F. V. Phillips of District VII would like to get his hands on a certain unidentified canine that recently caused him considerable inconvenience. Phillips was enjoying restful slumber after a hard day when the sheriff's office telephoned him that there was a dead dog on the highway, that traffic was dodging the animal's body and as a result there had been several near accidents. He tumbled out of bed immediately and drove to the designated spot on the highway. After placing red lanterns on both the front and rear of his car, he placed the machine in position to load the carcass. As Phillips reached down to grab a leg of the dog the animal sprang up and ran off across a field.

HIGHWAY RESEARCH BOARD TO MEET

The Sixteenth Annual Meeting of the Highway Research Board of the National Research Council will be held in Washington, D. C., on November 18–20.

SALINAS UNDERPASS OPENED TO TRAFFIC BY GOV. MERRIAM

(Continued from page 2)

Lake Street, the first intersecting street north of and parallel to the railroad tracks intersected the subway at right angles in the depressed portion before the subway grade reached the normal street level. It was necessary to abandon this street and relocate it a considerable distance north of its former location in order that a connection could be made from Lake Street to the subway.

PARK SUPPLANTS BUILDINGS

The triangular block formed by the intersection of North Main Street, Monterey Street and Sausal Street was formerly occupied by buildings and service stations. It was necessary to raze the buildings in this triangular area because in depressing both streets to carry them under the railroad tracks, all access to such buildings would be severed.

This area was transformed into a park which adds greatly to the visibility of motorists meeting at the intersection of the two streets, increases the safety of the subway and adds to the aesthetic features of the project.

The structure provides for three tracks of the railroad and has a minimum roadway width for highway vehicles of 44 feet between curbs. A five-foot sidewalk is provided on each side. The abutments of that portion of the structure supporting the railroad tracks are founded on 160 treated Douglas fir piles, each approximately 30 feet long.

Two automatic electric pumps each capable of discharging 750 gallons per minute have been installed to take care of all surface drainage water which flows into the subway.

PARK NICELY LANDSCAPED

Landscaping the park area at the southeast corner of North Main and East Lake Street and the triangular area bounded by Monterey, Sausal, and North Main streets was done as a part of the project. This beautification work consisted of importing top soil and placing same in the planting areas and planting lawn, trees and shrubs. A complete water supply and automatic sprinkler system was also installed.

Previous to starting the design of this structure a complete model was made by the State Bridge Department showing the exact details of the subway and surrounding area as it would look when completed. This model was placed on display in Salinas for the purpose of acquainting all the local citizens of the extent and character of the proposed improvement.

The city of Salinas cooperated by purchasing all necessary right of way and assuming the cost of all property damage. This was financed by a $140,000 bond issue which was voted by the citizens of Salinas on May 5, 1935.

The project provided employment for an average of 70 men for a period of 8 months or a total of 43,700 manhours. The indirect employment for which the project provided work in the various mills and manufacturing plants can be visualized from the following quantities of some of the classes of materials used in the construction of the project:

Forty-five thousand sacks of Portland cement were used; 20,000 gallons of asphaltic cement, 2400 gallons of road oils, 7500 cubic yards of crushed stone, 4300 cubic yards of sand, 674,400 pounds of structural steel, 142,700 pounds of reinforcing steel, 135,000 board feet of lumber, 4350 lineal feet of piling, 1100 lineal feet of metal culvert pipe, 5300 pounds of cast steel, 1700 lineal feet of cast iron pipe, 1500 lineal feet of vitrified clay pipe, 5500 pounds of copper strips and 3600 lineal feet of galvanized pipe.

Funds for this project were made available by the Emergency Relief Appropriation Act of 1935, United States Works Program Grade Crossing Projects. The total construction cost was $290,000.

The project was completed four months ahead of schedule.

FARMERS OWN 5,000,000 CARS

According to the most recent compilations made by the U. S. Bureau of the Census, farmers own more than one-fourth of all the motor vehicles in the United States.

The total number of motor vehicles owned by farmers exceeds 5,000,000.

Gratified by Many Going Contracts on Coast Route

IN THE NEWSLETTER for August published by the California Mission Trails Association, Ltd., General Manager C. M. C. Raymond writes:

"It is gratifying to see so many going contracts of highway improvement on the Coast Route in the Mission Trails territory. $1,755,115 is the cost involved on seven of these. They are:

Location	Length miles	Approximate completion date	Approximate cost
Salinas Underpass	0.181	7-28-36	$265,000
Soledad Underpass	0.525	9- 1-36	165,000
Soledad to Gonzales	8.264	10-15-36	146,163
Bradley to San Ardo	6.8	11- 1-36	343,534
No. and So. of Santa Maria	2.377	8-15-36	73,544
Tajiguas to Arroyo Hondo	3.126	11-15-36	226,874
Conejo Grade	----	12-31-36	535,000

For several years, the existing Cuesta Grade, just north of San Luis Obispo on the Coast Highway, has presented an unwelcome interruption to the motorist. Now, the California Highway Commission has appropriated $655,000 to cover the cost of rebuilding this winding highway over the Santa Lucia Mountains. For more than six years this Association has been one of the vital factors in championing and urging the reconstruction of this tremendously important piece of scenic highway, which will abolish sixty-three curves and provide safe and delightful traffic facilities for many years to come."

MANY JOBS ON U. S. ROADS

Full-time direct employment on Federal highway work during the fiscal year ended June 30, 1935, furnished 182,605 men with jobs, according to Thomas H. McDonald, Chief, U. S. Bureau of Public Roads.

Government highway activities for that period accounted for more than 5,000,000 man-months of direct and indirect employment, Mr. McDonald reports.

"You look all-in today, Bill. What's the trouble?"

Bill: "Well, I didn't get home until after daylight, and I was just undressing, when my wife woke up and said: 'Aren't you getting up pretty early, Jim?' In order to save an argument, I put on my clothes and came down to the office."

Realigned Road Saves Motorists $23,000 Gas Bill

It is getting figures down to a fine point when state engineers calculate the amount of saving to thousands of motorists in the elimination of a half-mile or so of curves. In relocation of a portion of the Redlands-Colton highway, District Engineer E. Q. Sullivan has it all worked out on paper that operators of something like 700 trucks and 3000 cars that travel this route daily will save not less than $23,000 in gasoline, oil, tires and, we suppose, patience. The new third lane has been opened to the public as far as the Santa Ana River bridge, greatly relieving traffic that was often blockaded without the middle passing lane. Next job will be to construct the link between this point and Colton, one of the most expensive jobs of the entire project between Los Angeles and Redlands. Already traffic has been speeded up enormously by improvements done within the last two months.

Redlands Facts.

CITY WAS OFFENDER

Frequently calls come to District Maintenance Offices that a truck is broken down on some bad curve or grade. A member of the maintenance crew at once rushes to the spot to flag traffic or place red lanterns. Recently Foreman H. E. Garris, down in District VII, late at night received a call from the police department of the city of Orange to the effect that a tractor and grader had been left at the pavement edge and was a menace to traffic. Garris investigated. He found that the offending tractor and grader were the property of the city of Orange and were parked on a portion of a State highway route maintained by the city. He placed red lanterns and then notified the police department that it had complained against equipment that belonged to its own city.

If all the automobiles in the world were placed end to end, 98 per cent of the drivers would start sounding their horns.—*From Better Roads.*

Bay Bridge Plaza to be Made Into Real Garden Spot

A CITY LOCALITY formerly very much "down at the heel" will soon be transformed into a true garden spot, thanks to the San Francisco-Oakland Bay Bridge.

This is the block at Fifth Street between Bryant and Harrison streets, the terminus of the main San Francisco approach to the bridge.

Under the direction of Chief Engineer C. H. Purcell and District Engineer Col. Jno. H. Skeggs, transformation of this block is now under way.

A total of 121,000 square feet will be planted with grass, trees, shrubs and flowers at an approximate expenditure of $19,000.

IN "MOOD" OF BRIDGE

Motorists approaching the bridge will be brought into the "mood" of the great structure, for State Arboriculturist H. D. Bowers, who has designed the landscaping scheme, has carried out the feeling of the bridge in the types of plants he has designated.

Of the 121,000 square feet to be cultivated, 64,000 square feet will be planted in lawn of seaside bent. The remaining 57,000 square feet will be devoted to coniferous plants and flowers.

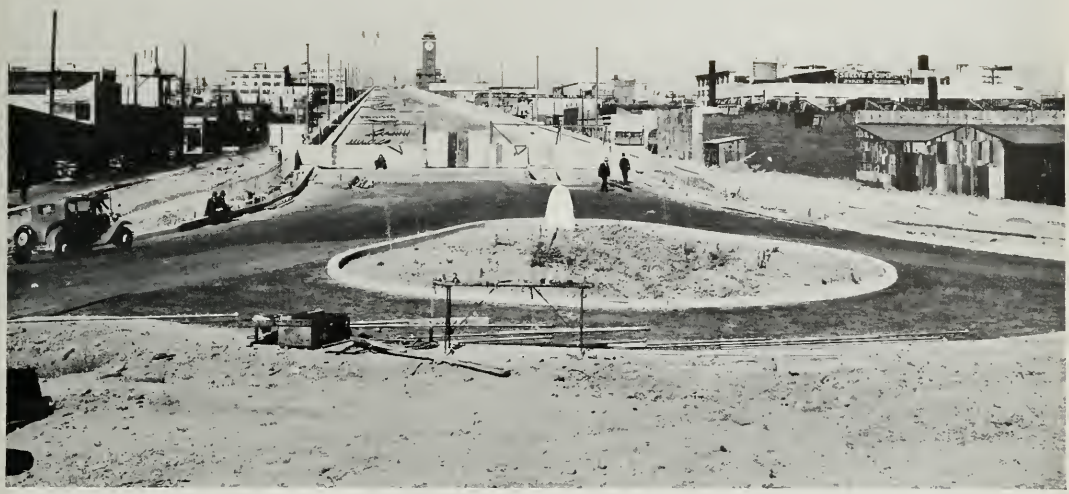
Two sturdy oak trees will carry out the motif of the bridge's great strength. The branches of eighteen redwood trees, grouped at either side of the approach, will continue in effect the design of the arching cables of the suspension spans which can be glimpsed as the autoist ascends the ramp.

SHABBY BUILDINGS SCREENED

Then there will be 52 trees of the Lawson cypress variety to be planted as a background and serve as a screen for the shabby buildings of the surrounding streets as the motorist first enters San Francisco from the bridge.

Incense cedars (forty of them) will serve as the accent points and give a silhouette effect, while eighteen slender Irish yews will lend a more formal air to the landscape. English holly will provide color and highlight the scene, while a Japanese boxwood hedge will border the area.

In all there will be 26 coniferous varieties totaling 900 plants.



The Fifth Street Plaza terminal of the main San Francisco approach to the San Francisco-Oakland Bay bridge as it is now and as it will look when completed and opened to traffic, on November 12th next is shown in the two pictures presented on this page. The above photograph was taken looking toward the bridge approach across the eastern point of the Plaza triangle for which an attractive landscaping design has been prepared as illustrated below.



The Plaza landscaping plan provides for planting 121,000 square feet on a scale that will make a garden spot in the heart of downtown San Francisco. Of this footage 65,000 square feet will be put in lawn and 57,000 square feet will be covered with plants, flowers and trees. The latter will include sturdy oaks, redwoods, cypress, cedars and Irish yews. The area will be bordered with English holly and Japanese boxwood. The plantings will include 52 trees and 900 plants.

Highway Bids and Awards for August, 1936

AMADOR COUNTY—Construction of fence at Ione Maintenance Station, District X, Route 97, Section A. Standard Fence Co., Oakland, $1,341; Pacific Fence Co., Los Angeles, $1,757; Kamlan Fence Co., San Francisco, $1,823. Contract awarded to Anchor Post Fence Co., San Francisco, $1,294.28.

BUTTE COUNTY—Between Sacramento River and Chico, about 3.1 miles to be surfaced with gravel and seal coat applied. District III, Route 47, Section A. A. Teichert & Son, Inc., Sacramento, $22,457; Reuben R. Carlson, Stockton, $42,758. Contract awarded Claude C. Wood, Stockton, $19,855.00.

CONTRA COSTA COUNTY—Between 3.5 miles west of Pittsburg and 5.5 miles north of Concord, about 3 miles to be surfaced with plant mix surfacing and shoulders to be constructed. District IV, Route 75, Section B, C. Pacific States Construction Co., San Francisco, $23,799. Contract awarded to Jones & King, Hayward, $23,262.50.

CONTRA COSTA COUNTY—Between Route 106 and Antioch, about 4.8 miles to be surf. with pl. mix. surf. District IV, Route 75, Section C. E. A. Forde, San Anselmo, $40,233; Chas. L. Harney, San Francisco, $49,583; Independent Const. Co., Ltd., Oakland, $41,616. Contract awarded to Pacific States Const. Co., San Francisco, $39,731.

COLUSA COUNTY—Between Williams and 2.7 miles east of Williams about 2.7 miles road bed to be widened and surfaced with gravel surface. District III, Route 15, Section A. Hanrahan Co., San Francisco, $22,301; C. C. Wood, Stockton, $24,580. Contract awarded to Clausen Embleton Co., Albany, $21,161.50.

DEL NORTE COUNTY—Between Winton Corners and Oregon State line, about 5.7 miles to be gr. surf. with ser. grav. on grav. base and tim. brs. to be constructed. District I, Route 71, Section B. N. M. Ball Sons, Berkeley, $135,879. Contract awarded to D. McDonald, Sacramento, $131,143.10.

GLENN COUNTY—Bdry. About 2.8 miles to be graded surfaced with crusher run base and pl. mix. surf. and a reinf. conc. gird. br. constr. Dist. III, Route 7, Section C. Union Paving Co., San Francisco, $105,429; Hanrahan Co., San Francisco, $114,206. Contract awarded to N. M. Ball Sons & Larsen Bros., Berkeley, $103,870.50.

HUMBOLDT COUNTY—0.07 miles between E and G Streets in city of Eureka, on Fourth Street. Surf. with bit. treated cr. gravel or stone. District I, Route 1, Section G, Eur. Contract awarded to Mercer Fraser Co., Eureka, $3,657.60.

HUMBOLDT COUNTY—Clean and paint shop and maintain buildings at Eureka, California, District I, Route 1, Section G, Eur. Contract awarded to A. Camilli, Eureka, $1,392.25.

HUMBOLDT AND TRINITY COUNTIES—Between 3.15 mile and 5.25 miles east of Blue Lake and at Gray Creek. About 0.7 miles to be graded and exist. tim. brs. rem. District I, Route 20, Sections B, C. A. T. Howe & Son, Santa Rosa, $22,644; A. Soda & Son, Oakland, $26,971. Contract awarded to Helwin Const. Co., Sebastopol, $22,150.

HUMBOLDT-TRINITY COUNTIES—Between 1.3 mile and 13.1 miles east of Bridgeville and at Clear Creek about 0.6 mile to be graded and 3 timb. brs. const. District I, Route 35, Section C, D. A. Mercer, Fraser Co., Eureka, $57,283; Chas. Harlowe, Jr., Oakland, $65,775; Heafey-Moore Co., Oakland, $69,409; A. Soda & Son, Oakland, $67,859; B. A. Howkins & Co., San Francisco, $58,232. Contract awarded to A. T. Howe & Son, Santa Rosa, $54,339.25.

IMPERIAL COUNTY—Between Meyers Creek and Dixieland, liquor asphalt to be applied to 17.5 miles. District XI, Route 12, Section A, B. Paulsen & March, Los Angeles, $2,701; Lamb's Trans. Co., Long Beach, $2,813; Morgan Bros., $2,615; Square Oil Co., $3,120. Contract awarded to Regal Oil Co., Long Beach, $2,314.

INYO COUNTY—8 miles to 10 miles south of Keeler, liquid asphalt to be applied for a distance of 1.8 miles. Regal Oil Co., Long Beach, $2,701; Paulsen & March, Los Angeles, $3,095; Lambs Transfer, Long Beach, $3,148; Gilmore Oil Co., Los Angeles, $3,287. Contract awarded to Square Oil Co., Los Angeles, $2,513.40.

INYO AND MONO COUNTIES—Furnish and apply liquid asphalt, SC-2, to approximately 20.8 miles of existing roadbed, District IX, Route 63, Section B. C. A. Lambs Transfer Co., Long Beach, $4,284; Oilfields Trucking Co., Bakersfield, $4,749; Paulsen & March, Los Angeles, $5,370; Square Oil Co., Los Angeles, $4,500. Contract awarded to Regal Oil Co., Long Beach, $3,897.

KERN COUNTY—Kern River overflow channel and Calloway Canal, about 0.3 mile to be graded, road mix surf. treatment applied and two timber bridges with concrete decks to be constructed. District VI, Route 141, Section A. Contract awarded to Rexroth & Rexroth, Bakersfield, $20,191.30.

KERN COUNTY—San Bernardino County line to Route 23, Applying Class "A" seal coat for approximately 35.2 miles. District IX, Route 145, Section A, B, C. Basich Bros., Torrance, $14,504; Geo. Herz & Co., San Bernardino, $15,537; A. S. Vinnell Co., Los Angeles, $13,334. Contract awarded to Square Oil Co., Los Angeles, $13,006.

LAKE COUNTY—Between Middle Creek and Rassmussen's Ranch, about 1.3 mile to be graded and surfaced with screen grav. on grav. base and const. 3 timber bridges. District I, Route 15, Section A-B. N. M. Ball Sons & Larsen Brothers, Berkeley, $78,828; Charles Kuppinger, Lakeport, $84,123; Heafey-Moore Co., Oakland $99,563; A. T. Howe & Son, Santa Rosa, $72,993. Contract awarded to Harold Smith, St. Helena, $69,545.

LASSEN COUNTY—Between 2.5 miles south of Viewland and Secret Valley, about 13.8 miles to be graded and penetrate. Oil trmt. appl. District II, Route 73, Section B. Heafey-Moore Co., Oakland, $163,365; Isbell Const. Co. Reno, $114,589; Frederickson & Westbrook, Lower Lake, $110,168; A. Tiechert & Son, Inc., Sacramento, $118,133. Contract awarded to Harms Bros., Doyle, $94,310.50.

LASSEN COUNTY—Between Westwood and Coppervale, about 6.6 miles to be graded and surfaced with crusher run base and plant mix surfacing. District II, Route 29, Section A. Isbell Construction Co., Reno, Nevada, $110,515; A. Teichert & Son, Inc., Sacramento, $114,327; Frederickson & Westbrook, Lower Lake, $120,861; Geo. Pollock Co., Sacramento, $127,166; Heafey-Moore Co., Oakland, $133,557. Contract awarded to Union Paving Co., San Francisco, $102,635.

LOS ANGELES COUNTY—Cerritos Avenue between Firestone Boulevard and Telegraph Road, about 1.8 mile to be graded and paved with A. C. District VII, Route 168, Section B. United Conc. Pipe Corp., Los Angeles, $91,509; So. Cal. Roads Co., Los Angeles, $85,727; Griffith Co., Los Angeles, $85,394. Oswald Bros., Los Angeles, $83,191. Contract awarded to Geo. R. Curtis Paving Co., Los Angeles, $74,467.60.

LOS ANGELES—Between Norwalk and Miraflores, about 12 miles to be graded and paved with A. C. P. C. C. and plant mix surf. District VII, Route 174, 178, Section B, A. and Aua. Geo. R. Curtis Paving Co., Los Angeles, $233,770; Griffith Co., Los Angeles, $233,416; Sander Pearson, Santa Monica, $223,173; United Conc. Pipe Corp., Los Angeles, $247,755; Gogo & Rados, Los Angeles, $221,225; Oswald Bros., Los Angeles, $221,267. Contract awarded to C. O. Sparks and Mundo Eng. Co., Los Angeles, $209,322.

LOS ANGELES COUNTY—In Pasadena between Club Road and El Circulo, about 0.4 mile to be graded and paved with P. C. C. and a reinf. conc. subway str. constructed. District VII, Route 161, Section Pas. Contract awarded to J. E. Haddock, Ltd., Pasadena, $89,449.80.

MENDOCINO COUNTY—Between Outlet Creek and Reeves Creek, about 4.5 miles to be graded and surf. with grav. base and scr. gravel. District I, Route 1, Section F. Peninsula Paving Co., San Francisco, $213,632; George Pollock Company, Sacramento, $244,055; Frederickson & Westbrook, Lower Lake, $199,947; Isbell Construction Co., Reno, Nevada, $223,278; Union Paving Co., San Francisco, $209,325; N. M. Ball Sons & Larson Bros., Berkeley, $190,853; D. McDonald, Sacramento, $231,462. Contract awarded to Hemstreet & Bell, Marysville, $180,546.20.

MODOC COUNTY—Between Thomas Creek and 2.5 miles west of Cedarville, 7.1 miles road-mix surfacing. District II, Route 28, Section C. Contract awarded to Frederickson & Westbrook, Lower Lake, $14,300.

MONO COUNTY—Furnish and apply liquid asphalt, SC-2, to approx. 5.1 miles of existing roadbed. District IX, Route 40, Section A. Square Oil Co., Los Angeles, $2,080; Lambs Transfer Co., Long Beach, $2,520; Paulsen & March, Los Angeles, $2,626. Contract awarded to Regal Oil Co., Long Beach, $1,882.40.

MONO COUNTY—Between Conway summit and 1 mile north of Bodie Road, about 7.6 miles to be graded and surfaced with bit. tr. sel. matl. District IX, Route 23, Section H. I. Morrison, Knudson Co., Inc., Los Angeles, $248,673. Contract awarded to Isbell Constr. Co., Reno, Nevada, $221,855.60.

MONTEREY COUNTY—Between Seaside Road and Salinas River, about 7.3 miles of rd. mix surf. treatment and seal coat to be applied. District V, Route 56, Section I. L. A. Brisco, Arroyo Grande, Calif., $36,871; Earl W. Heple, San Jose, $31,206. Contract awarded to Granite Construction Co., Ltd., Watsonville, $23,556.

NEVADA COUNTY—Between Donner Lake and Truckee, about 2.4 miles to be gr. and surf. with cr. run base and pl. mix. surf. District III, Route 37, Section D. A. Teichert & Son, Inc., Sacramento, $72,958. Contract awarded to Pacific States Const. Co., San Francisco, $56,659.45.

NEVADA COUNTY—Between Grass Valley and Nevada City, about 2.9 miles to be

faced with plant mix surfacing. District 11, Route 17, Section B. Pacific States Construction Co., San Francisco, $39,162. Contract awarded to Independent Construction Co., Ltd., Oakland, $36,250.

ORANGE COUNTY—Road mix surf. to be applied to shoulders Los Angeles County line to Santa Ana River, 12.2 miles. District VII, Route 179, Section A. A. S. Vinnell Co., Los Angeles, $12,146; C. R. Butterfield, San Pedro, $10,990. Contract awarded to So. California Roads Co., Los Angeles, $10,732.50.

RIVERSIDE COUNTY—Between Hemet and Moreno and between Perris and National Forest boundary east of Hemet—about 36.2 miles. Apply road mix surf. trmt. to shoulders. District VIII, Routes 34, 194, Section K, L. C. C. W. Wood, Stockton, $53,700; Oilfields Trucking Co., Bakersfield, $49,623; Basich Bros. Torrance, $57,680; A. S. Vinnell Co., Los Angeles, $50,299. Contract awarded to Sou. Calif. Roads Co., Los Angeles, $47,555.25.

RIVERSIDE COUNTY—Between 2½ miles west of Beaumont and Beaumont, about 2.4 miles to be gr. and surf. with pl. mix surf. and a reinf. conc. br. to be const. District VIII Route 19, Section D. Gibbons & Reed Co., Burbank, $105,505; Matich Bros. Elsinore, $99,937; Dinmitt & Taylor, Los Angeles, $98,860; Griffith Co., Los Angeles, $101,814; C. O. Sparks & Mundo Engr. Co., Los Angeles, $104,608. Contract awarded to Oswald., Los Angeles, $84,781.70.

SAN BERNARDINO COUNTY—Between Amboy and 17 miles easterly. About 0.4 mile, construct two timber trestles, construct and surface approaches with salvaged surface material and apply el. "B" seal coat. District VII, Route 58, Sections J and K. Contract awarded to Basicb Bros., Torrance $22,569.70.

SAN BERNARDINO COUNTY—Between Mountain Pass and Nevada state line. About 15.4 miles to be gr. and bit. rd. mix. surf. tr. appl. District VIII, Route 31, Section P. V. R. Dennis Const. Co., San Diego, $405,201; David H. Ryan, San Diego, $328,321; Wood & Bevanda, Stockton, $358,489; Basich Bros., Torrance, $393,761; Sander Pearson, Los Angeles, $341,210; Gibbons & Road Co., Burbank, $295,939; Isbell Const. Co., Reno, Nevada, $317,393; Griffith Co., Los Angeles, $311,889. Contract awarded to Geo. Pollock Co., Sacramento, $285,202.70.

SAN BERNARDINO COUNTY—Between Cajon Pass Summit and Victorville, about 9.9 miles to be surf. with pl. mix. surf. (S. C. type) and seal coat applied. District VIII, Route 31, Section C. Southwest Paving Co., Inc., Roscoe, $35,343; Oswald Bros., Los Angeles, $34,944. Contract awarded to Geo. Herz & Co., San Bernardino, $31,813.60.

SAN BERNARDINO COUNTY—Between Upland and San Bernardino and between Redlands and National Forest boundary. About 18.4 to be surfaced with plant mix surf. (S. C. type) and seal coat applied. District VIII, Route 190, Section A, B, D. Geo. Herz & Co., a corp., San Bernardino, $48,457. Contract awarded to Oswald Bros., Los Angeles, $43,186.

SAN BERNARDINO COUNTY—Between Victorville and Barstow. About 36 miles. Apply rd. mix. surf. tr. to shldrs. District VIII Route 31, Section D, E. F. C. N. Wood, Stockton, $45,825; Oilfields Trucking Co., Bakersfield, $43,663; R. E. Hazard & Sons, San Diego, $40,662. Contract awarded to Matich Bros., Elsinore, $38,362.50.

SAN DIEGO COUNTY—Between Del Mar and Encinitas, about 6.6 miles to be graded and paved with A. C. District XI, Route 2, Section A. V. R. Dennis Const. Co., San Diego, $297,835; W. E. Hall Co., Alhambra, $285,007; C. O. Sparks & Mundo Eng. Co., Los Angeles, $299,250; Basich Bros., Torrance, $282,644; David H. Ryan, San Diego, $295,317; Daly Corporation, San Diego, $287,450; Oswald Bros., Los Angeles, $294,400. Contract awarded to Griffith Co., Los Angeles, $279,221.95.

SAN DIEGO COUNTY—Reinforced concrete bridge across Las Chayas Creek at Main Street in San Diego, 3 30' sp's on conc. pile bents and conc. abuts. with timber pile fds. to be const. and approx. 0.19 mile of road to be graded and surfaced with plant mix surf. for detour. Dist. XI, Route 2, Section S. D. B. O. Larsen, San Diego, $35,970; M. H. Golden, San Diego, $39,725. Contract awarded to V. R. Dennis Const. Co., San Diego, $33,723.59.

SAN FRANCISCO-OAKLAND BAY BRIDGE—Install sprinkler system in Harbor Piers 24 and 26. Rockwood Sprinkler Co. of Mass., San Francisco, $113,420. Contract awarded to Grinnell Co. of the Pacific, San Francisco, $106,194.

SAN FRANCISCO—Construction of the Yerba Buena Island garage of the San Francisco-Oakland Bay Bridge. Contract awarded to Alfred H. Vogt Co., Inc., San Francisco, $14,633.

SAN LUIS OBISPO AND MONTEREY COUNTIES—Between Paso Robles and 0.2 mile north of San Luis Obispo-Monterey County line, about 10.8 miles, road-mix surface treatment to be applied to shoulders. Granite Constr. Co., Watsonville, $14,067; L. A. Brisco, Arroyo Grande, $10,887. Contract awarded to Oilfields Trucking Co., Bakersfield, $10,764.20.

SAN MATEO COUNTY—Between San Mateo and Redwood City, about 7.3 miles surf. portions with bit. tr. surf. (pl. mixed) District IV, Route 68, Section C. Jones and King, Haywards, $59,932; Peninsula Paving Co., San Francisco, $59,982; Union Paving Co., San Francisco, $62,612; Pacific States Const. Co., San Francisco, $64,971; Chas. L. Harney, San Francisco, $67,721; United Contracting Co., Portland, Ore., $67,954; Hanrahan Company, San Francisco, $76,964. Contract awarded to Leo F. Piazza, San Jose, $59,925.

SANTA BARBARA COUNTY—Between 4.8 miles east of Guadalupe and Santa Maria River, about 4.6 miles in length, armor coat to be applied to existing base. District V, Route 148–56, Section A, E. Granite Constr. Co., Watsonville, $12,490. Contract awarded to L. A. Brisco, Arroyo Grande, $11,950.

SANTA CRUZ COUNTY—Bridge across Rodeo Gulch 1.7 mile east of city limits of Santa Cruz 2 60' pl. gird. sps. and 4 30' st. str. sp's with conc. deck on ex. conc. piers and abuts. District IV, Route 56, Section A. Lindgreen & Swinerton, Inc., Oakland, $28,132; F. O. Bonnett Co., Campbell, $28,821; Earl W. Heple, San Jose, $25,302; W. J. Tobin, Oakland, $24,808. Contract awarded to A. Soda and Son, Oakland, $24,384.55.

SANTA CRUZ COUNTY—2 bridges, one across Fall Creek and one across San Lorenzo River at points approximately S and 14 miles, respectively, north of Santa Cruz. District IV, Route 116, Section A and B. F. P. Bonbett Co., Campbell, $29,105; A. Soda & Son, Oakland, $25,785; Lindgren & Swinerton, Inc., Oakland, $31,222; Earl W. Heple, San Jose, $29,055. Contract awarded to W. J. Tobin, Oakland, $22,053.

SANTA CRUZ COUNTY—In Santa Cruz on Ocean Street between Pryce and Water Streets and on Mission Street between Bay and Younglove Streets. About 0.8 mile widen portion with P. C. C. pavements, walk and curb and surf. port. with nat. rock asph. District IV, Routes 5, 56 Section S. Cr. Clausen-Embleton Co., Albany, $18,810; L. C. Seidel, Oakland, $21,969; Granite Const. Co. Ltd., Watsonville, $18,959. Contract awarded to Earl W. Heple, San Jose, $18,046.

SHASTA COUNTY—Between Sulphur Creek and Boulder Creek Hill and at Sulphur Creek Hill—about 1.8 mile to be graded and surfaced with r. mx. surf. on crush. run base. District II, Route 3, 28, Section B. A. Poulos & McEwen, Sacramento, $140,084; A. Teichert & Son, Inc., Sacramento, $147,251; Fredericksen & Westbrook, Lower Lake, $106,464; Union Paving Co., San Francisco, $139,280; D. McDonald, Sacramento, $125,534; Hanraban Company, San Francisco, $125,780; George Pollock Company, Sacramento, $149,613; Isbell Construction Company, Reno, Nevada, $129,238; P. L. Crooks & Co., Inc., Portland, Ore., $147,763; Dunn & Baker, Klamath Falls, $133,500. Contract awarded to Guy F. Atkinson Company, San Francisco, $103,728.

SHASTA COUNTY—Between Redding and Millville, 12.6 miles Class B, seal coat. District II, Route 20, Section C. C. F. Fredericksen & Sons, Lower Lake, $10,268; Lee J. Immel, Berkeley, $13,200. Contract awarded to Dunn & Baker, Klamath Falls, Oregon, $10,256.

SIERRA COUNTY—Between Sierraville and Calpine, about 8.0 miles gravel blanket to be placed over the existing roadbed. District III, Route 83, Section B. Garcia Const. Co. Irvington, $15,900. Contract awarded to Fredericksen & Westbrook, Lower Lake, $13,875.

SOLANO COUNTY—Between Westerly boundary and Cordelia and between county hospital and Fairfield. About 3.7 miles to be graded and surfaced with bit. tr. surf. plant mixed). District X, Routes 8, 7, Section A, B. Pacific States Constr. Co., San Francisco, $54,963; Hanraban Company, San Francisco, $57,659; Louis Biasotti & Son, Stockton, $59,956. Contract awarded to A. G. Raisch, San Francisco, $52,080.30.

SOLANO COUNTY—In city of Benicia, about 0.3 mile, to be graded and surfaced with plant mixed surfacing. Dist. X, Route 74, Section Ben. Independent Const. Co., Ltd., Oakland, $11,538; Reuber R. Carlson, Stockton, $13,879. Contract awarded to Louis Biasotti & Son, Stockton, $9,709.70.

TEHAMA COUNTY—Between Route 86 and Morgan Springs, about 3.8 miles untreated surfacing. District II, Route 83, Section A. Hein Bros. Basalt Rock Co., Petaluma, $14,092. Contract awarded to E. B. Bishop, Orland, $13,370.

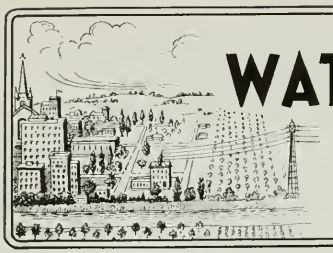
TULARE COUNTY—Between ¼ mile south of Strathmore and Valencia Street in Lindsay, and between Eastwood Avenue, in Lindsay and Cairns Corner. About 6.8 miles to be graded and surf. with pl. mix. surf. on a crush. run base and appl. rd. mix. surf. trmt. to shldrs. District VI, Route 134, 129, Section B, C. Lindsay. Hanrahan Company, San Francisco, $161,228; Union Paving Co., San Francisco, $156,757. Contract awarded to N. M. Ball Sons & Larsen Bros., Berkeley, $155,203.10.

TULARE COUNTY—Between Rte. 134 and Visalia. About 8.1 miles cr. run base bdrs. to be const. bit. seal coat appl. and rd. mix surf. trmt. appl. to shldrs. District VI, Route 132, Section A. Stewart & Nuss, Inc., Fresno, $36,567; John Jurkovich, Fresno, $37,475; N. M. Ball Sons, Berkeley, $39,050. Contract awarded to Union Paving Co., San Francisco, $32,605.00.

TUOLUMNE AND MARIPOSA COUNTIES—Between Moccasin Creek Dam and 0.8 mile south of Counterville (X Tuo-Mpa 65 B-A) about 11.5 miles in length. Liquid asphalt to be furnished and applied. District X, Route 65, Section B-A. Sheldon Oil Co., Suisun, $8,474; Hayward Bldg. Material Co., Hayward, $9,945. Contract awarded to Lambs Transfer Co., Long Beach, $7,033.42.

VENTURA COUNTY—Grading and surfacing with plant-mixed surfacing between Clark and Sudden Barrancas, 0.23 mile. District VII, Route 79, Sec. A. Oswald Bros., Los Angeles, $6,604. Contract award-

(Continued on page 24)



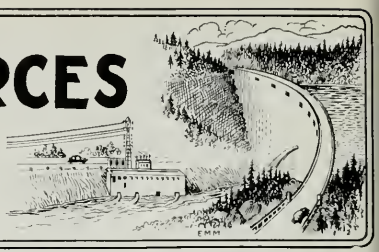
DIVISION OF WATER RESOURCES

OFFICIAL REPORT

FOR THE MONTH OF

August, 1936

EDWARD HYATT, State Engineer



COINCIDENT with preliminary investigations and exploration work at Kennett and Friant dam sites of the Central Valley Project by the United States Bureau of Reclamation, the Consulting Board of Engineers of the bureau, accompanied by the State Engineer and members of his staff made an inspection trip during August to view the progress of the work on the project.

The engineers inspected the Kennett, Baird and Table Mountain sites and Friant dam site.

IRRIGATION DISTRICTS

Resolutions have been received from the boards of supervisors of Fresno and Tulare Counties relative to the sufficiency of petitions filed for the organization of four irrigation districts in the San Joaquin Valley.

Field investigations were made during the month of the proposed Orange Cove, Ivanhoe, Exeter and Lindmore districts and feasibility reports on each, are now in preparation.

The proposal of Richvale Irrigation District to annex 3142 acres of land and to issue bonds for the purchase of additional water rights was investigated and reported upon to the District Securities Commission.

The plans of Sutter Water District to issue bonds, construct an irrigation system, and purchase water from Sutter Butte Canal Company were examined, and a field investigation was made of lands in the district.

DISTRICTS SECURITIES COMMISSION

At the regular monthly meeting of the Commission held in San Francisco, August 14, 1936, the following matters were given consideration:

Petition of Pacheco Pass Water District to hold an election for the purpose of authorizing a bond issue in the amount of $180,000, to carry out a proposed plan of irrigation, was granted.

Application of Richvale Irrigation District for the approval of a bond issue in the amount of $90,000, to finance the purchase of additional water rights and canals for recently included lands, was referred to the State Engineer for report.

Request of Sutter Water District for authorization to issue bonds in the amount of $95,000, for the purpose of constructing a distribution system within the district, was approved.

Petition of Fairoaks Irrigation District for approval of an expenditure of $500, for employment of an engineer to report upon betterments to the water system, was granted.

FLOOD CONTROL AND RECLAMATION

Relief Labor Work

Clearing of the Feather River channel above Marysville in Yuba County has been continued with relief labor, and an average of 45 laborers have been employed. New applications have been submitted for WPA projects to clear in the Feather River channel, the American River overflow channel and the Upper Sutter By-pass. It is expected that the program for the use of relief labor will assume larger proportions than in any previous program, commencing in late fall and extending through the winter and spring.

Bank Protection Program

The maintenance bank protection program by the State and Federal Government under the agreement of June, 1932, has been ordered resumed by Major General Edward Markham, Chief of Engineers, and the schedule of work to be performed immediately has been approved. This will involve the expenditure of approximately $400,000. The work is to be done by the U. S. War Department for the protection of the banks of the Sacramento River, the Federal Government paying two-thirds of the cost and the State one-third.

Sacramento Flood Control Project

Considerable work has been done at the request of the Reclamation Board on the incidental construction in connection with acquiring and clearing levee rights-of-way for levee units now under contract by the California Debris Commission. This is being done in 11 different locations, on both banks of the Sacramento River above Colusa and on the American River near Perkins. Approximately 35 men are employed on this work and a number of buildings are being moved under contract.

SUPERVISION OF DAMS

Application for approval of the amended application for construction of the Long Valley Dam of the City of Los Angeles, located on Owens River, was filed on July 21, 1936. Revised plans of the same have been submitted.

Application for construction of the Mono Dam of the city of Santa Barbara was filed on July 27, 1936. This structure is being constructed in conjunction with the Forest Service for the purpose of controlling debris entering the Gibraltar Dam of Santa Barbara. The structure is of the ambursen type, 33 feet in height and storing 1500 acre-feet of water. The structure is estimated to cost $128,271.

Application was filed on August 11, 1936, for approval of the plans for construction of the Putah Creek dam by the city of Winters. The dam is to located on Putah Creek near Winters and is to be a concrete gravity dam with flashboards having a height of 11 feet and a storage capacity of 177 acre-feet. Its purpose is to replenish the underground water supply of the district. It is estimated to cost $15,168.

Application for approval of the plans for the alteration of the Fern Lake dam of the Sonoma State Home was filed on August 7, 1936. The work contemplated consists in raising the crest elevation of the north dam, flattening the slopes of the same and reconstruction of the spillway lining.

Application was filed on August 12, 1936, for approval of the plans for repairs to the Pine Creek dam of the California Public Service Company at Alturas, consisting of enlargement of the spillway.

Application for approval of the plans for the construction of the Long Lake dam of the California Fruit Exchange, located on Gray Eagle Creek in Plumas County, filed on March 16, 1936, was approved on July 31, 1936.

Application for approval of the plans for alteration of the No. 2 Huntington Lake dam of the Southern California Edison Company located on Big Creek in Fresno County, filed on July 3, 1936, was approved on July 20, 1936.

In Southern California work is progressing satisfactorily on the San Gabriel Number 1 and Eaton Wash dams of the Los Angeles County Flood Control District. Work on the Cajalco dam of the Metropolitan Water District, and the Grant Lake and Long Valley dams of the city of Los Angeles, Department of Light and Power, is progressing. Repair to the Hodges Dam of the city of San Diego is proceeding rapidly and construction work on the Judson Dam of the California Water and Telephone Company is now well under way.

At Santa Barbara the Sheffield Reservoir enlargement is nearing completion.

In northern California many repair jobs are being prosecuted. Concrete is being poured in the lower levels of the O'Shaughnessy dam enlargement. Excavation for foundations is continuing at the Mad River dam of the city of Eureka. Work is progressing satisfactorily at the Arcata Dam for a water supply for Arcata. Work has been resumed on the Coyote Dam of the Santa Clara Valley Water Conservation District after a period of inactivity. The West

Valley Dam of the South Fork Irrigation District in Modoc County is nearing completion.

Repair and maintenance inspection work has been carried on as usual.

WATER RIGHTS

Supervision of Appropriation of Water

Twenty-seven applications to appropriate water were received during July; eight were denied and twenty-six were approved. Four permits were revoked and rights under four-teen permits were confirmed by the issuance of license.

Inspections were made during the month in Inyo, Mono, Mariposa, Calaveras, Alpine, Amador, El Dorado, Placer and Sacramento counties preliminary to the issuance of license or revocation.

Clover Creek (Shasta County)—A stipulation for substitution of parties covering ten changes in ownership is being circulated. Water master service in accordance with the stipulation for judgment was continued throughout the month.

Susan River (Lassen County)—The tentative plan of distribution, agreed upon for trial during the current season, was administered throughout the month. A stipulation for judgment is being circulated and has been signed by over eighty per cent of the parties involved.

Rader Creek (Modoc County)—Attorneys representing a majority of the parties in this case contemplate a re-reference to the Division covering all issues raised by the pleadings, instead of the limited reference originally made.

COOPERATIVE SNOW SURVEYS

During the past month work in the office, in addition to routine matters, has consisted of bringing up to date all records of precipitation using data received from stations maintained by the U. S. Weather Bureau, State, Districts, and Public Utilities. In the field a start has been made toward preparing for next winter's snow surveys and it is planned to make measurements again at all snow courses surveyed last winter.

In addition to extending further the range of snow surveys into areas where insufficient measurements have been made in the past, arrangements have been made for 23 new stations to be established and surveyed under State supervision and in accordance with adopted standards.

The necessary equipment for measuring the snow pack at these new stations is to be supplied by the Division of Irrgation, Bureau of Agricultural Engineering, U. S. Department of Agriculture. At twenty of the new stations the annual measurements will be made by rangers of the U. S. Forest Service and at the remaining three, in the vicinity of Hetch Hetchy, the surveys will be made by the City of San Francisco.

SACRAMENTO-SAN JOAQUIN WATER SUPERVISION

During the past month the activities of this office have been on routine detail so that a report may be made at the end of the irrigation season which will show the amount of water diverted from and returned to streams in the Sacramento-San Joaquin area. It will also show the amount of land irrigated, the flow in the stream channels and the rate of advance and retreat of salinity in the delta.

The stream flow has about reached its minimum stage and by the end of the month an increase in stage should be noted. This increase will be due to lessened pumping and rice field drainage. Several large areas of rice are being slowly drained and the end of the mouth should see most of the fields in the process of draining.

The salinity in the Sacramento River Delta should not show any great increase over its present state but will remain about constant for about three weeks and then as the flow in the Sacramento River picks up will gradually recede. However, the salinity in the San Joaquin River Delta should continue to slowly increase for about a month and will not show any marked decrease until the flow in the San Joaquin River increases.

For purposes of comparison with last year, the following salinity data are given for a few key stations:

SALINITY

Station	1935 Max.	1935 8/14	1936 Max.*	1936 8/14
Point Orient	1720	1700	----	1640
Bullshead Point	1260	1060	----	1060
O and A Ferry	540	520	520**	440
Antioch	290	220	260	160
Collinsville	390	282	370	210
Jersey	86	----	75	24
Rio Vista	12	----	6	2

* Estimates, from April Bulletin of California Cooperative Snow Surveys.
** August 10th.

TOPOGRAPHIC MAPPING

Mapping of Tobias Peak Quadrangle proceeded during the month in Tulare and Kern counties and progress was made in office work in connection with revision of the culture along the San Andreas Fault in San Bernardino County.

The following final quadrangle sheets became available during the month:

Antelope Plain in Kern County, covering a part of the Antelope Plain and Lost Hills area and published on a scale of 1:31,680 with 5 feet contours.

North of Oildale in Kern County, covering the Poso Creek area and published on a scale of 1:31,680 with 5 and 25 feet contours.

White River in Tulare and Kern Counties, covering a part of the White River and Deer Creek area and published on a scale of 1:62,500 with 50 feet contours.

El Rico Ranch in Kings County, covering a part of the Tulare Lake Bed area and published on a scale of 1:31,680 with 5 feet contours.

Del Sur in Los Angeles County, covering a portion of the Antelope Valley, Portal Ridge, Leonis Valley area and published on a scale of 1:24,000 with 5 and 25 feet contours.

Red Rock Mountain in Los Angeles County, covering part of the Angeles National Forest and published on a scale of 1:24,000 with 25 feet contours.

Worm Springs in Los Angeles County, covering part of the Angeles National Forest and published on a scale of 1:24,000 with 25 feet contours.

WATER RESOURCES

South Coastal Basin Investigation

Good progress has been made in the field and office on the South Coastal Basin Investigation during the present month.

San Luis Rey River Investigation—San Diego County

The investigation and survey of San Luis Rey River in San Diego County for the purpose of securing data and preparing plans for flood control, rectification of the river channel and the conservation and utilization of the waters of the San Luis Rey River being made by the Division of Water Resources in cooperation with WPA, City of Oceanside, County of San Diego and Carlsbad Mutual Water Company will be completed during the middle or latter part of September, after which a report on the results of the survey will be prepared by the Division of Water Resources.

CENTRAL VALLEY PROJECT

Preliminary investigations and exploration work have been carried on during the month at Kennett and Friant dam sites and surveys continued along the Contra Costa Conduit and Friant-Kern Canal by the United States Bureau of Reclamation. Appraisers are working in the field evaluating lands and necessary rights of way required for the construction of the project. The Division of Highways has made studies of foundation conditions at the site of the combination highway and railway bridge across the Pitt River and the Division of Water Resources is conducting surveys and making investigations in the San Joaquin Valley preliminary to the acquisition of properties and water rights necessary for the construction of the project.

During the latter part of August an inspection trip of the project was made by the Consulting Board of Engineers for the United States Bureau of Reclamation. Kennett, Baird and Table Mountain sites were inspected and the work done to date by the United States Bureau of Reclamation reviewed. The Board then spent a few days in Sacramento going over the work of the project in the Sacramento office and proceeded to the Friant dam site to review the work done at that location. The Board was composed of Mr. Charles H. Paul of Dayton, Ohio, Professor W. F. Durand of Stanford University, Roy V. Meikle of Turlock, and Dr. Charles P. Berkey of Columbia University, New York. The Board was accompanied on its inspection trip by Mr. J. L. Savage, Chief Designing Engineer, and Mr. E. B. Debler, Hydrographic Engineer, United States Bureau of Reclamation, both with headquarters at Denver, Colorado. Mr. Walker R. Young, Construction Engineer in charge of the Central Valley Project for the United States Bureau of Reclamation, Mr. Edward Hyatt, State Engineer of California, and Messrs. Edmonston, Hawley and Waddell, engineers of the Division of Water Resources, also accompanied the Board on its inspection trip.

NO WALKS TO SCHOOL FOR THESE

Statistics gathered from school officials throughout the United States reveal that approximately 3,000,000 children are transported to and from school in more than 77,000 motor buses.

The motor vehicle industry in the United States last year consumed 885 million pounds of crude rubber.

PAVEMENT BUTTONS AN AID TO NIGHT DRIVING

(Continued from page 12)

Fortunately these reflectorized curve signs present equally consistent visibility day or night, and the positioning and use of these signs is directed through a central authority so that the same position and appearance is always presented to the motorist.

Our traffic striping costs from $18 to $25 a mile. Reflector button pavement markers at present prices cost $150 for the smallest to $405 per mile in place. The white pavement stripe is efficient at all times and is easily repainted when necessary because of new pavement or from being obliterated by oil from traffic or pavement.

MAINTENANCE COST QUESTION

The maintenance cost of the reflector button pavement markers has not been determined. Our present installations have been made to determine this cost. Accurate reports are being kept to show how often it is necessary to clean these buttons to maintain their reflecting power, to show the breakage, and the wear and tear on the markers. Observations to date are not sufficient to make any definite statement in answer to this maintenance question.

It has been found that some of the markers in certain locations require cleaning once a week to obtain the same efficiency as when installed. In one location of 20 markers, after two months of use, all but ten of the forty reflector buttons were broken or missing entirely. Some of the castings were badly worn so that the button, if replaced, would not have protection from traffic.

In another location 50 per cent of the button installations required replacement.

Assuming as stated that the use of these markers should be held to dangerous curves, it is readily seen that with no such locations on our new highways their use is largely restricted to our older highways.

Much study was made to determine the locations for the tests being carried on and the majority of the most hazardous locations now have these markers.

All of these installations have been made in the past few months. During this time we have enjoyed fair weather with a warm pavement. What will happen to the reflecting efficiency of these buttons in wet and foggy weather is a question to be answered from observation.

Experience with the reflector buttons in our present signs shows that condensation materially reduces the return reflection. Will the closeness to the pavement with the dust and moisture affect this return reflection to a point where daily maintenance would be required?

The question follows, are these reflector pavement markers an economical and efficient method of reducing traffic hazards? In the opinion of this department this question can be better answered after their use has been tested, their maintenance costs obtained, and a study made to see what will happen in wet and foggy weather.

This is the data that is being obtained and compiled from the present test installations.

HIGHWAY BIDS AND AWARDS FOR AUG., 1936

(Continued from page 21)

ed to Kovacevich & Price, Inc., South Gate, $5,701.50.

VENTURA COUNTY—A reinforced conc. br. across San Antonio Creek, about 73 miles north of Ventura, 3 55' and 2 26' gird. sps. on conc. piers and abuts. to be const. District VII, Route 13S, Section A. Lindgren & Swinerton, Inc., San Francisco, $41,425; R. R. Bishop, Long Beach, $43,634; Heafey-Moore Co., Oakland, $43,747; Byerts & Dunn, Los Angeles, $44,604. Contract awarded to C. O. Sparks and Mundo Eng. Co., Los Angeles, $39,476.

YOLO COUNTY—Between Willow Slough and Woodland, about 4.4 miles to be surf. with plt. mix. surf. and untr. cr. gr. or st. bdrs. const. District III, Route 7, Section A. Independent Const. Co. Ltd., Oakland, $46,134; Pacific States Const. Co., San Francisco, $49,928; A. Teichert & Son Inc., Sacramento, $47,980; Heafey-Moore Co., Oakland, $42,702. Contract awarded to E. A. Forde, San Anselmo, $41,679.50.

YOLO COUNTY—Between Second Street and Elm Street in Woodland, about 0.2 mile to be paved with crusher run base, stabilizing base and plant-mixed bit. treated surfacing. District III, Route 7, Section Wd, Pacific States Construction Co., San Francisco, $14,804. Contract awarded to A. Teichert & Son, Inc., Sacramento, $13,974.45.

"How did you like those Chinese backscratchers I brought you?"

"Is that what they were? Chinese backscratchers! My wife's been making me eat salad with them!"

Gasoline Supply Assured for at Least 25 Years

PROVED petroleum reserves in the United State are 100 per cent greater than was estimated 10 years ago and, properly managed, are adequate to meet requirements at least for 25 years, with assurance that when needed a virtually unlimited supply will be available from coal and from oil shales.

This analysis of the outlook for the petroleum industry is contained in a report submitted to the board of directors of the American Petroleum Institute by the National Petroleum Trade Association's executive committee in answer to alarmists who claim this country faces a shortage of petroleum products and resultant scarcity of gasoline.

PLENTY OIL AVAILABLE

Improved methods of discovery, development and recovery will make available additional large supplies of oil not only from fields as yet undiscovered, but also of oil heretofore unrecovered from old fields, the report says.

At the time of the 1925 survey, known petroleum reserves were estimated at 5,321,000,000 barrels, with indications that additional reserves would be found. In the ten years since that calculation, 8,692,000,000 barrels of oil have been produced and consumed, yet more than 12,000,000,000 barrels of proved reserves are known to be still below ground.

"The fact that proved reserves of oil in the ground now are conceded by authorities to be well over 100 per cent greater than in the 1925 estimate has had no influence with the alarmists," the report states, and adds that as a result of the advances made by science, technology and invention, the reserves still to be located and developed are far greater than ever estimated before.

Husband—If there was any darned fool in love with you before we got married, I'm sorry you didn't marry him.

Wife—I did marry him—don't you remember your own wedding?

Small boy: Dad, what are the holes in the board for?

Dad: Those are knotholes.

Small boy (after due consideration): Well, if they're not holes, what are they?

STATE OF CALIFORNIA
Department of Public Works

Headquarters: Public Works Building, Eleventh and P Sts., Sacramento

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EARL LEE KELLY.....Director

JUSTUS F. CRAEMER.....Assistant Director
EDWARD J. NERON.....Deputy Director

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FRED J. GRUMM, Engineer of Surveys and Plans
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L. V. CAMPBELL, Engineer of City and Cooperative Projects
R. H. STALNAKER, Equipment Engineer
E. R. HIGGINS, Comptroller

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F. W. HASELWOOD, District II, Redding
CHARLES H. WHITMORE, District III, Marysville
JNO. H. SKEGGS, District IV, San Francisco
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DIVISION OF WATER RESOURCES

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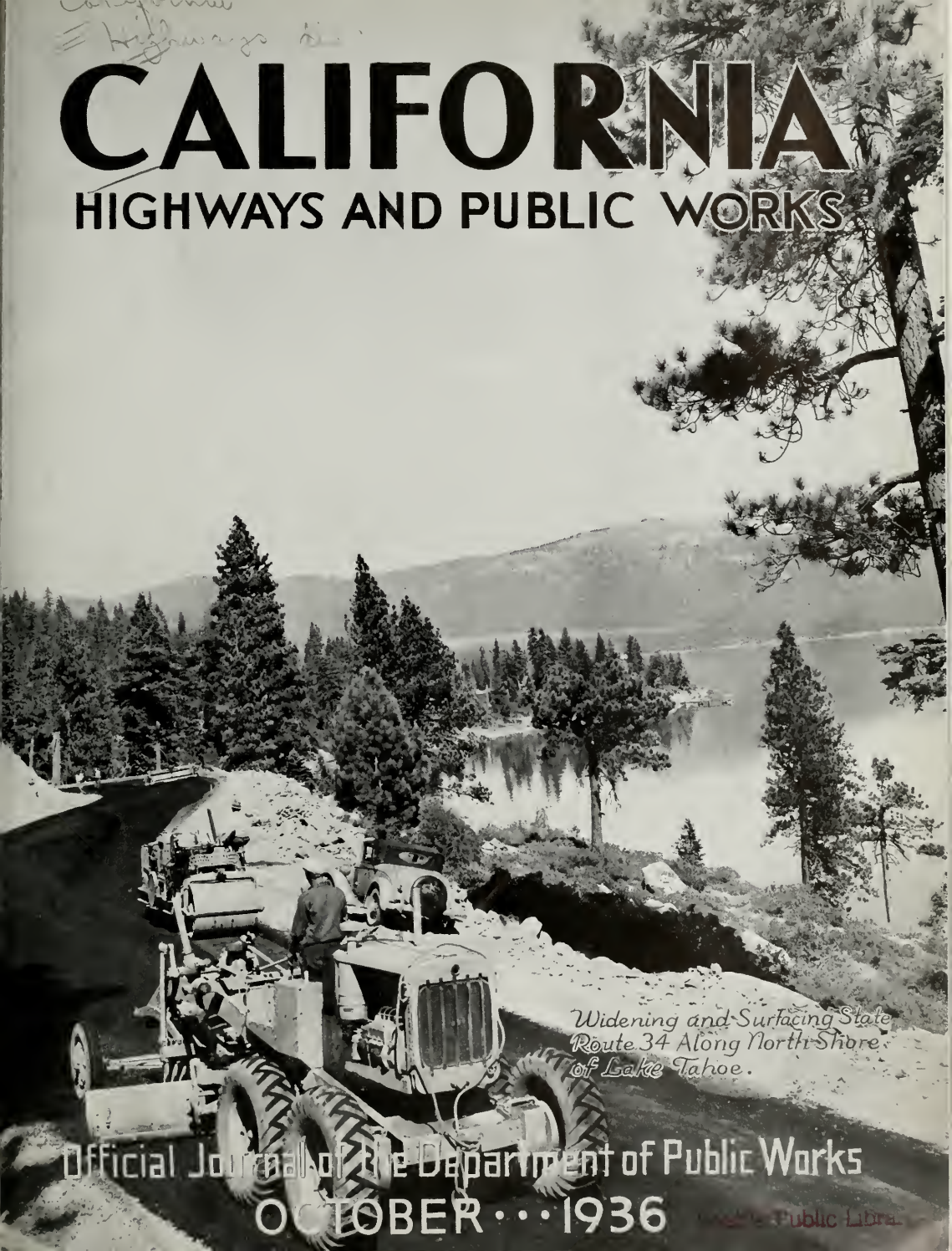
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CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways of the Department of Public Works, State of California

EARL LEE KELLY, Director | C. H. PURCELL, State Highway Engineer | JOHN W. HOWE, Editor

Published for information of the members of the department and the citizens of California

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Governor Merriam to Open San Francisco-Oakland Bay Bridge November 12th

CALIFORNIA will celebrate the formal opening to automobile traffic of the $77,000,000 San Francisco-Oakland Bay Bridge, greatest structure of its kind in the world, at 10 o'clock on the morning of November 12.

Highlighting a four days' jubilee in observance of the event, a ribbon barrier on the Oakland side of San Francisco Bay will be officially broken at that hour and Governor Frank F. Merriam, Director of Public Works Earl Lee Kelly and State Highway Engineer Charles H. Purcell will lead an automobile caravan across the bridge for appropriate dedication ceremonies which will be held on the San Francisco side at 11 o'clock.

State, Federal and county officials, officers and men of the U. S. battle fleet and the army, squadrons of army and navy planes and citizens of the entire bay region and many sections of California will participate in the exercises and gala celebration events.

PARADE BEGINS CEREMONIES

Celebration of this epochal event will begin on November 11, Armistice Day, in Oakland, with a parade in the morning, a military luncheon at the Hotel Oakland, a military pageant, football game and boat races on Lake Merritt in the afternoon and fireworks and a regatta on the lake in the evening. A ball at the Oakland Auditorium, open to the public without admission charge, will conclude the festivities on the first day of the four-day fiesta.

On November 12, coincident with the dedication ceremonies on both sides of the bay, the San Francisco Citizens' Committee, working through the Junior Chamber of Commerce of San Francisco, will stage a series of maritime events in which the battle fleet will take part and navy and army flyers will put on a spectacular air show.

Following exercises on the San Francisco side, the official party will return to Oakland for luncheon as the guests of the eastbay city.

In the afternoon, the start of the Pacific Coast yacht regatta will dot the entire bay north of Yerba Buena shoals with white sails. Later there will be a flight of commercial planes, fish-boat races, air races, merchant life-boat races, a fire-boat demonstration off Yerba Buena shoals, a Coast Guard exhibition and Sea Scouts' races off the Marina, outboard motor and rowing races and swimming and diving events at Aquatic Park. In the evening brilliant displays of fireworks on both sides of the bay will signalize the lighting of the bridge.



GOVERNOR FRANK F. MERRIAM

On November 13, San Francisco will celebrate with a great parade that will move from the Ferry Building to the Civic Center, where grandstands accommodating 40,000 persons will be erected. A feature of this event will be a pageant of floats depicting the past, present and future of the metropolitan bay area. Twenty-two counties already have accepted invitations to participate.

A spectacular pageant of light is scheduled for Saturday night, November 14, in San Francisco. Floats showing replicas of all the great bridges in the world will move up Market street and past the grandstands and on each will be singers and dancers representing the nations in which the bridges depicted were built.

San Francisco's churches will hold special services on Sunday, November 15, to present the spiritual aspect of progress as represented in the completion of the bridge.

300,000 VISITORS EXPECTED

Transportation experts anticipate at least 300,000 visitors to the bay region during the celebration and in honor of the occasion San Francisco will be brilliantly decorated. Along Market street silver and rainbow-hued decorations will suggest an elongated bridge with great silver structures spanning the thoroughfare at eight different points.

The foreign quarters of the city will be decked in gala attire, and

every hotel, the principal restaurants and night clubs and theaters will produce special events. There will be fireworks each night.

Anticipating a heavy demand for the souvenir fifty-cent piece being issued to commemorate completion of the bridge, the San Francisco-Oakland Bay Bridge Celebration Committee has arranged with every bank in the bay area to accept and handle orders for the coins.

45 MILE SPEED LIMIT

Representing as it does a highly important link in the transcontinental and State highway systems, the San Francisco-Oakland Bay Bridge will offer to motorists the finest highway facilities in existence.

An effective safety measure is provided automobile drivers in the separation of pleasure cars from trucks and heavier motor vehicles, such as buses. These latter will be routed over the three lanes of the lower deck, while automobiles will speed over the six lanes of the upper deck. Traffic regulations, on the whole, will be those applying to all California State highways, with the speed limit set at 45 miles per hour. No minimum limit has been set.

Motorists will not have to worry about pedestrians, bicycles or animals, all three being expressly prohibited from using the vehicular crossings.

A special bridge detail under Captain Rudy Schmoke of the California Highway Patrol will be assigned to duty for the protection of motorists. Its members will have headquarters in the Administration Building on the Toll Plaza.

POLICE PHONE SYSTEM

A system of police phones has been installed. These phones, 22 in number, extend from the junction of the "off" ramp and the main approach west of the San Francisco anchorage to the distribution structure in Oakland. They connect directly with the desk sergeant at the Administration Building.

The phones are a typical handset, enclosed in a box, so arranged that when an officer inserts his key into the box the signal and its positions are recorded in the Administration Building, and even should he not be able to call, aid would immediately be sent him.

A violet fresnel lens placed on the police box will signal the officer on duty, should the desk sergeant wish to talk with him.

The San Francisco-Oakland Bay Bridge stretches into two counties, Alameda and San Francisco, making it necessary to establish a boundary line for the purpose of determining to which county justice the erring motorist will be sent should he be charged with violating traffic regulations.

This boundary has been determined at Pier E-6, about half way over the East Bay Crossing.

In addition to police phones, 32 tow car signals for the convenience of motorists have been installed on the bridge. These signals will be enclosed in a box with a fire signal and connect directly with the garage and fire station east of the east portal on Yerba Buena Island. The tow car signals will be operated like the ordinary fire signal, by the breaking of a glass dial, and the registered signal will indicate the location of the distressed motorists.



C. H. PURCELL, Chief Engineer of Bay Bridge

Three-wheel motorcycles are being contemplated for use by the bridge patrol, so that gasoline and individual fire equipment may be carried conveniently by each officer when necessary.

No other highway lighting in the United States will equal the vast illuminating system of the San Francisco-Oakland bridge. Sodium vapor lighting will be used. It not only is cheaper to operate than the incandescent light, but is a great contribution to safety in night driving. It provides improved vision without glare and can allow for the elimination of headlights.

This lighting system will illuminate approximately 15 miles of roadways, including the bridge proper, its upper and lower decks and its approaches. The lights will be placed at a distance of about 150 feet apart and will be wired on a staggered system, permitting a circuit to be cut out without plunging any one section of the bridge into darkness. A total of 1074 sodium luminaires, including 10,000 and 6000-lumen lamps, will be required to light the roadways.

SIXTEEN TOLL LANES

The entire lighting system will be operated through a 26-foot control board in the Administration Building.

All tolls will be collected at the Toll Plaza, adjacent to the Administration Building on the Oakland side.

Sixteen lanes will pass by the toll booths, twelve of which will be utilized by pleasure cars and four by trucks. Trucks and automobiles will, of course, be separated. A sidewalk indicator will show in lights the amount paid in tolls by the motorists. All tolls will be collected, and not dropped into a box.

The expediting of traffic after it leaves the bridge has been one of the great problems. On the east side, the difficulty was solved through the Distribution Structure, which distributes traffic in three directions, without necessitating a left-hand turn or a right-angle crossing.

AN INTERLACING VIADUCT

Traffic reaches Alameda and lower Oakland through an approach to Cypress and Seventh streets; to central Oakland, through an approach to 38th and Market streets, via the San Pablo Underpass; and to Berkeley, Albany, and Richmond, through a four-lane approach, the East Shore Highway.

The Distribution Structure has a

(Continued on page 14)

BAY BRIDGE FINISHING SCENES

At right—View of upper deck of suspension span with its six traffic lanes completely paved.

Below—San Francisco end of top deck showing main central approach to Fifth Street Plaza with off-ramp (right) to Clementina and First streets and on-ramp from Harrison and Fremont.





Below—View of top deck entrance to tunnel through Yerba Buena Island.







At left—Views of the lower bridge deck with its three-lane paved roadway for trucks and two tracks for railway cars.

Death Valley Roads Restored After Summer Cloudbursts

By S. W. LOWDEN
Acting District Engineer

RESTORATION work on Route 127 of the State Highway Secondary System extending from Lone Pine easterly through Death Valley to the town of Baker in San Bernardino County, 14.5 miles of which were completely destroyed by torrential floods caused by cloudbursts last summer, was recently completed by the Division of Highways and the road reopened to traffic.

Approximately 57.7 miles of Route 127 were damaged by the storms. In several instances and shortly after repairs had been made under great difficulties by the maintenance forces of District IX subsequent floods again caused great havoc.

Damage was particularly heavy through the Darwin Wash bordering the westerly side of Panamint Sink and in the vicinity of Towne's Pass the westerly gateway to Death Valley proper. On the sections of State highway that were not totally destroyed, debris was deposited in depths varying from 1 foot to 4 feet. On the sections completely wiped out numerous washes were encountered that at places reached a depth of 8 feet below the former roadbed.

PRESENTS WEATHER PARADOX

For ages past the strange, arid area that is Death Valley, lying between Mount Whitney in the Sierra Range on the west, and the Mojave Desert to the east, has, rather paradoxically, been deluged by cloudbursts during July and August, the hottest months of the summer.

Last summer was no exception and numerous electrical storms accompanied by exceedingly heavy rains were experienced. Many of the washes through which Route 127 passes and which had not carried water for a number of years were filled with raging torrents, in some of them the water reaching a depth of from 3 to 5 feet.

These floods carried rocks of various sizes and huge quantities of gravel for many miles with the consequent destruction of all improvements in the way of roads and highways that lay within their path rendering them totally impassable to traffic.

Contrary to the popular belief that the Death Valley area is uninhabitable or not traversable during the summer season, work carried out by the Division of Highways and by the National Park Service during the last three years has resulted in such betterment of existing roads that an appreciable amount of travel is encountered throughout the main valley highways even during the extreme heat of summer.

It is considered remarkable, therefore, that during the series of storms affecting this region during July and August no persons were injured or seriously endangered. The only damage other than that suffered by Highway 127 was to one car caught in the flood of Darwin Wash. This machine was abandoned by the occupants and completely wrecked in the swirling waters.

Route 127 follows, in general, the course of the wagons of the early immigrants and is located for the most part through what is ordinarily known as the dry washes of the mountains, over alluvial fans that have been accumulating since the time that Death Valley was an inland sea.

ROAD WASHED AWAY

An interesting section of this State highway extends from the foot of Darwin Wash across the Argus Mountains through Panamint Valley and over the Panamint Mountains by way of Towne's Pass to Stove Pipe Wells in Death Valley, a distance of 31 miles. It formerly was the famous Death Valley toll road. It became a free highway in December, 1934, when the State acquired it by purchase. It was on a portion of this road through the Darwin Wash and near Towne's Pass that the greatest amount of damage was done last summer.

Between Darwin and Panamint Valley destruction of the highway was complete at several points and debris was piled deep on the road. In Darwin Wash run-off water obliterated the highway.

Highway shoulders and oil mix surfacing on the stretch between Furnace Creek and Death Valley Junction were swept away. Cross washes between Shoshone and Baker deposited large quantities of heavy debris and destroyed highway shoulders.

TOLL FEES ABOLISHED

The old toll road acquired by the State and where restoration work is extensive was constructed by H. W. Eichbaum, a pioneer of Death Valley, in 1926 under a franchise granted to him by Inyo County. Motorists using the road were charged $2 per car and 50 cents per person. When the State took over the route and placed it in the highway system these fees were abolished.

The Eichbaum Road became a part of Route 127. It ended at Stove Pipe Wells where a connection is made with a road through Daylight Pass to the abandoned mining towns of Rhyolite and Bullfrog and thence to Beatty and Tonopah, Nevada.

From Stove Pipe Wells, State Route 127 bends southeast to Death Valley Junction via Furnace Creek, to which point last summer's floods reached, and then runs south via Shoshone to a connection with State Route 31 (The Arrowhead Trail) at Baker.

WEIRD SCENIC BEAUTY

As a direct east-west highway across Death Valley, Route 127 provides for interstate traffic and attracts thousands of tourists each year. The scenic beauty of the region through which the highway passes is unusual. The mountains on the east and west sides of Death Valley rise precipitously from elevations below sea level to heights of more than a mile. The Grapevine and Armagosa ranges on the east are made up of layer upon layer of

(Continued on page 6)



Cloudbursts over Death Valley wrought much damage to State Highway No. 127 during the summer. Top pictures show typical washes of oil mix surfacing and deposits of debris on summit of Towne Pass, the western gateway. Center—Complete loss of road at lower end of pass. Bottom pictures show heavy cross-wash and damage to rubble masonry slope on sections of eastern approach via Shoshone.

OVERPASS GRADE SEPARATION AT TRACY OPENED TO TRAFFIC

By R. B. ANDERSON
Resident Engineer

IN THE presence of several hundred citizens and prominent city, State and Federal officials, Director Earl Lee Kelly of the Department of Public Works dedicated and opened to traffic on September 26th the overhead grade separation on State Highway No. 5 (U. S. No. 50) near the city of Tracy in San Joaquin County.

The ceremony marked the completion of another unit in the statewide grade separation program being financed with Federal funds through the U. S. Bureau of Public Roads for the elimination of some of the most dangerous grade crossings in California.

An elaborate program ararnged by the Tracy Chamber of Commerce in collaboration with the Central Valley Council of the State Chamber started with the dedicatory ceremonies and ended with a dinner at the Tracy Inn attended by more than 250 civic leaders and officials.

MAIN TRAFFIC ARTERY

Following the cutting of the ribbon by Director Kelly hundreds of cars passed over the long concrete and steel structure which carries the main highway traffic artery between the San Francisco Bay region and San Joaquin Valley above the tracks of the Southern Pacific Railroad about one-half mile east of Tracy.

During the brief ceremonies held on the structure Director Kelly said that due to the heavy traffic on this highway and the number of accidents that had occurred at this particular crossing a grade separation had been under consideration by the Division of Highways for several years but funds had not been available for its construction.

Other speakers included Chairman Harry A. Hopkins of the California Highway Commission; District Engineer R. E. Pierce; Congressman Frank Buck; President C. P. Button of Tracy Chamber of Commerce; Mayor Fred Herzog of Tracy and Chairman C. E. Steinegul of San Joaquin County Board of Supervisors.

The cost of the entire project is approximately $250,000. The contractors were Lindgren & Swinerton and 58,000 man-hours of labor were employed during construction.

TOTAL LENGTH 3021 FEET

The structure is 1441 ft, in length, consisting of one 81-foot and two 48-foot plate girder spans, two 52-foot steel beam spans, and twenty-nine 40-foot reinforced girder spans, supported upon concrete column bents and caps. The footings of the bents are founded upon treated timber piling.

The approaches are paved with Portland cement concrete for a distance of 480 feet at each end of the structure. The entire length of the project is 3021 feet. A 34-foot roadway is provided on the structure and approaches with a 3-foot sidewalk on each side.

The four bents of the structure adjacent to and paralleling the railroad tracks are on a skew of 64 degrees from a normal to the center line of the highway. Collision walls were constructed between the columns of each of these bents, which give them a continuous face to a height of 7 feet above the top of the rails.

ROOM FOR EXTRA TRACK

Provision was made in the design of the structure for the construction of an additional track on each side of the existing double track railroad line.

At the official dinner in the evening, President Button of the Tracy Chamber of Commerce presided and Mr. Kelly was the principal speaker. He spoke informally, congratulating the citizens and organizations of the Tracy section on their cooperation, community spirit and enterprise and closed by making a plea for safe driving, declaring that 50 per cent of auto accidents are caused by 10 per cent of the drivers.

"We can build fine, safe highways," said Mr. Kelly, "but we can not cope with the accident toll unless there is more careful driving."

Congressman Buck told of the Federal appropriations for highway construction work that will be available for the fiscal year 1937-38.

Among those present introduced by the chairman were:

John F. Blakeley, chairman of the highway committee of the Central Valley Council of the State Chamber of Commerce; E. H. Kundert, president of the San Joaquin County Chamber of Commerce; Carl Knudsen, chairman of the highway committee of the San Joaquin Chamber of Commerce; Clarence A. Coggin, president of the Stockton Chamber of Commerce; A. M. Robertson, secretary-manager of the Stockton Chamber of Commerce; Charles Wherry, president of the Modesto Chamber of Commerce; Fred A. Tatton, manager of the Central Valley Council; C. E. Steinegul, chairman of the San Joaquin County Board of Supervisors; E. K. Finney, chairman of the Stanislaus County Board of Supervisors; Mayor Fred Herzog of Tracy; John B. Davidson, vice president of Lindgren & Swinerton, contractors for the overpass, and Carl Herziger, superintendent of construction for the contractors.

DEATH VALLEY ROADS RESTORED AFTER CLOUDBURSTS

(Continued from page 4)

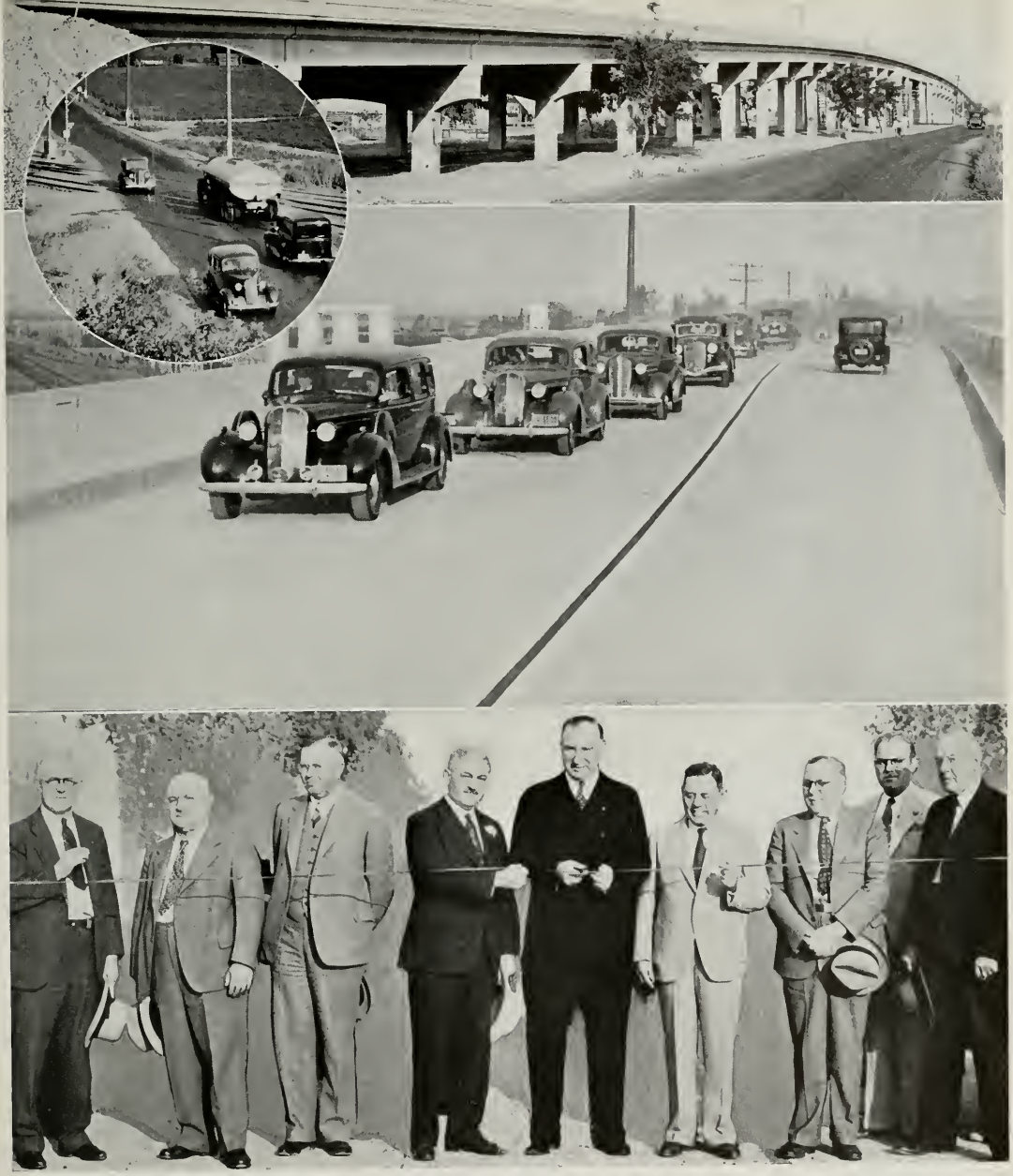
stratified rocks of many colors, particularly brilliant in the vicinity of Furnace Creek.

It is estimated that approximately 50,000 visitors to Death Valley used the State highway leading to points of interest last year.

The Division of Highways has been rushing the work of highway restoration in the hope that the opening of the winter tourist season in Death Valley will find Route 127 in the same excellent condition as prevailed before last summer's storms.

119,096 TOURISTS IN JULY

Figures just released show that 119,096 nonresident motor vehicle permits were issued in July 1936, as against 89,050 for the same month last year; an increase of 30,046 or 33.74 per cent. More than eighty-five per cent of the permits were issued at the eight border checking stations maintained by the department.



Scenes at dedication and official opening of overhead grade separation project near Tracy on State Highway 50, the main traffic artery between San Francisco Bay region and the San Joquin Valley. At top—Overpass structure, 1441 feet long, spanning Southern Pacific railroad tracks. Old grade crossing shown in inset. Center—Parade of autos across new overpass after ribbon was cut. Structure provides a 34-foot roadway and two sidewalks. Bottom—Official party at ribbon cutting ceremony, left to right, C. B. Button, President Tracy Chamber of Commerce; Fred Herzog, Mayor of Tracy; District Engineer R. E. Pierce; Congressman Frank H. Buck; Director Earl Lee Kelly of Department of Public Works, wielding the scissors; Chairman Harry A. Hopkins of California Highway Commission; Clarence Coggins, President Stockton Chamber of Commerce; E. C. Stewart and A. M. Robertson.

Last Grapevine Canyon Unit Completed and Opened

By R. M. GILLIS
District Engineer

RECONSTRUCTION of the Grapevine Canyon Grade on the route through the Tehachapi Mountains between Los Angeles and Bakersfield became a reality with the opening to traffic on August 31 of the Lebec-Fort Tejon unit of this project, the last link in this major highway improvement.

The Grapevine undertaking encompassed the continuance in Kern County of the Ridge Route Alternate improvement in Los Angeles County and its completion under three separate contracts calls attention to striking features of the project.

construction of these Grapevine Canyon units was the work of changing the channels of Grapevine and Cuddy creeks to control flood waters. While there were a few channel changes on Grapevine Creek on Units 1 and 2, extensive channel changes and diversion dykes on both Grapevine and Cuddy were required on Unit 3, just finished.

For the control of Grapevine Creek and its tributaries, almost a mile of channel changes and dykes were constructed. The creek was carried under the highway four times in box culverts, ranging in size from single 8-foot by 8-foot to double 8 by 8 boxes.

Cuddy Creek being in a cloudburst area, its control was of the greatest importance to prevent damage to and loss of the road in times of flood. This operation called for the construction of 6000 lineal feet of channel change and dykes, and a reinforced concrete bridge, consisting of four thirty-three foot spans.

In addition to the two major flood control operations, there were changes made on minor water courses which aggregate well over half a mile.

Realignment of the route was complicated considerably by the fact that there were three gas lines, three oil lines and two power transmission lines all on private rights of way in the narrow confines of Grapevine Canyon. All of these were in conflict with the adopted location at many points. The moving of these various utility lines slowed up work as their removal had to be made during slack operation periods.

Completion of the Lebec-Fort Tejon unit gives to the Ridge Route a thirty-foot Portland cement concrete pavement from Los Angeles to the foot of



Construction of Unit 1 wiped out the tortuous hairpin curves on the climb up from the old Grapevine Station on the floor of the valley. Unit 2 did away with the aptly named Deadman's Curve, while Unit 3 eliminated the winding, rolling grade between Fort Tejon and the Los Angeles County line.

A large increase of traffic on the Ridge Route Alternate following the completion of this part of the route in Los Angeles County made an immediate widening of Unit No. 1 imperative.

An outstanding task accomplished by the Division of Highways in the Grapevine, about twenty-nine miles south of Bakersfield.

At the inception of the project, it was determined to grade a 46-foot roadway and place a 20-foot pavement. Unit 1 was so planned and constructed. Traffic, however, had increased so remarkably with the opening of the Ridge Route Alternate that Unit 2 provided for a 30-foot pavement on the new construction, and an additional 10-foot lane on Unit 1 as well. In view of traffic growth, Unit 3 was constructed as a three-lane pavement.

The Ridge Route Alternate, in Los

(Continued on page 23)









The narrow old road on the section of the Grapevine Canyon between Fort Tejon and Lebec follows the contours of the hills with some steep grades and 119 sharp turns in 11.91 miles as shown in picture No. 2 while the new highway route pursues an almost straight course across country on new location as shown in Nos. 1, 3 and 4, providing three traffic lanes with only 23 easy curves for a distance of 10.71 miles.

Construction Progress and Pavement Records for 1935

By EARL WITHYCOMBE, Assistant Construction Engineer

IN THE construction of various types of pavements during 1935, the selection of materials for the immediate subgrade continued to be of primary importance. It is becoming general practice to set up a blanket course to be obtained from an outside source, for a project that is spotted with poor soils, rather than depend upon obtaining the material from within the roadway section by cross hauling.

Funds expended in such corrective measures should return attractive future dividends in increased service life of pavements.

PORTLAND CEMENT CONCRETE

Construction Records

The maximum average daily output of concrete pavement, reduced to an 8-hour comparative basis, was placed on Contract 67VC13-57VC1-47CS16, in Los Angeles County, Redondo Beach to Wilmington, where the United Concrete Pipe Corporation placed 432.3 cubic yards per day, using one paver. L. R. McNeely was resident engineer, with H. D. Johnson as street assistant. The average daily output for the State during 1935 was 343.3 cubic yards, as compared to 402.0 cubic yards in 1934.

The reduction in average daily production in this and other types of paving during 1935 is no doubt due to the disruption of contractors' organizations owing to the necessity of absorbing local relief labor.

Strongest Concrete

The **strongest concrete** placed during 1935 was on the same contract, 67VC13, with an average compressive strength of 5751 pounds per square inch. The average strength for the State was 4965 pounds, compared to 4465 pounds in 1934.

Cement Control

The record for **cement control** was made on Contract 68XC13-58XC4, in San Bernardino County, Riverside Avenue to Colton, with an average variation of 0.36 per cent. B. G. Carroll was the contractor, and E. A. Bannister was resident engineer, with W. Crawford, street assistant. The average variation for the State was 0.93 per cent, compared to 0.9 per cent in 1934.

Surface Smoothness

The record for **surface smoothness** was obtained on Contract 67XC11 in Orange County, where the average roughness index per mile was 5.6 inches. The contractors were Sharp & Fellows, the resident engineer, F. R. Pracht, and street assistant, G. H. Lamb. The average roughness index for the State on concrete pavements was 9.3 inches per mile, compared to 8.3 inches during 1934.

The increase in roughness is the result of being obliged to operate with partially inexperienced crews.



Nojoqui Grade on U. S. 101, the Coast Highway between Las Cruces and Buellton in Santa Barbara County, paved with 20-foot Portland cement concrete.



Thirty-foot asphalt concrete pavement on the Rincon section of the Coast Highway between Ventura and Carpinteria.

CONSTRUCTION METHODS AND DESIGN

Finishing of concrete pavement was performed in the specified manner with the one exception of Contract 67VC20-47VC24 in Orange County, where a box type of drag finisher, perfected by assistant resident engineer H. G. Johnson, was used for the first time. This finisher eliminated all floating with the exception of the steel-shod cut float used as a final finisher.

The use of the diagonal float as a substitute for the longitudinal float has become universal.

Reinforcement

Edge reinforcement was practically abandoned in the 1935 season's work. The only steel used was a single $\frac{1}{2}$" square deformed bar on each side of the transverse joint to support the dowels.

Joint Construction

At the instigation of the U. S. Bureau of Public Roads, $\frac{3}{4}$" dowels placed on 14" centers were used at all designed transverse joints. Expansion joint intervals ranged from 60 feet to 100 feet with joint widths varying from $\frac{1}{2}$ inch to $\frac{3}{4}$ inch. Weakened plane joint intervals ranged from 20 to 30 feet.

Curing

The majority of projects were cured with water, but colorless membrane was used as a curing medium to a very limited extent. A few cotton mats were purchased and used experimentally for curing purposes in District VII.

ASPHALT CONCRETE

Construction Records

The maximum daily output of asphalt concrete was obtained on Contract 67XC9, in Los Angeles and Orange counties, between Downey and Buena Park, with 810.7 tons per 8-hour day. United Concrete Pipe Corporation was the contractor, E. A. Parker the resident engineer, and K. D. Lewis, street assistant. The average daily output for the State was 520.5 tons, compared to 594.4 tons in 1934.

Pavement Quality

The highest **average stability** of surface mixture was 4209 pounds, obtained on Contract 611VC12, in San Diego County, Emerald Avenue to East City limits, El Cajon. The contractor was V. R. Dennis Const. Co., the resident engineer, L. E. Liston, and L. E. Crayne, street assistant. The average stability for the State was 2908 pounds compared to 2950 pounds in 1934.

The **densest surface mixture** was found on Contract 67XC17, in Los Angeles County, Prairie Avenue to Commercial Street, Ingleside, with a relative specific gravity of 98.3%. United Concrete Pipe Corporation was the contractor, L. R. McNeely, resident engineer, and E. D. Davis, street assistant. The State average was 95.0%, compared to 95.9% in 1934.

The **smoothest surface** was obtained on Contract 67XC23 in Los Angeles County, between Los Angeles Street and Artesia Avenue, with 11.1 inches per mile. The contractor was Oswald Brothers, the resident engineer, W. J. Calvin, and A. L. Hawkins, street assistant. The State average was 21.1 inches per mile, compared to 21.4 inches in 1934.

CONSTRUCTION METHODS

With the large increase in the number of asphalt concrete projects during 1935, due to resurfacing of existing concrete pavement, new personnel has been added to organizations connected with this type of construction, and considerable ex-

(Continued on page 23)

PORTLAND CEMENT CONCRETE PAVEMENT RECORDS FOR 1935

Location	Contractor	Resident Engineer	Street Assistant	Average cu. yds. laid per 8-hour day	Average strength, 28 days—lbs. per square inch	Per cent average daily variation in cement	Roughness index, inches per mile
North entrance to Redding	T. M. Morgan Co.	M. Frederickson	A. A. Bigelow	102.4	4311	0.98	10.5
Gaviota Creek—Nojoqui Creek	Hanrahan-Wilcox Corp.	M. H. Hubbs	H. J. Doggart	381.6	3598	.41	9.0
Ft. TeJon—1 mi. N. of Grapevine Sta.	Griffith Company	F. M. Reynolds	P. Coykendall	416.5	4754	.90	7.5
State St.—Mission St., Los Angeles	C. O. Sparks & Mundo Engr. Co.	M. L. Bauders	W. A. MacInnes	380.5	4580	.62	10.5
Monterey Park—Mountain View Road (por)	Oswald Brothers	C. P. Montgomery	J. Fleharty	162.9	4270	2.60	14.1
Redondo Beach—Wilmington	United Concrete Pipe Corp.	L. R. McNeely	H. D. Johnson	432.3	5751	.72	9.6
Winter Canyon—Las Flores Canyon	Los Angeles Paving Co.	E. L. Seitz	E. C. Daniel	357.6	4981	1.00	14.2
Loma Ave.—Hathaway Ave.	Sully-Miller Contr. Co.	G. E. Farnsworth	G. H. Lamb	256.1	5077	.98	7.8
Stanley Ave.—Loma Ave.	Sully-Miller Contr. Co.	W. D. Eaton	C. J. McCullough	168.5	4360	1.43	14.4
California Ave.—Colorado Ave.	J. L. McClain	C. N. Ainley	J. R. Rubey	357.7	5251	1.06	13.0
Pier Ave.—Sepulveda Blvd.	J. L. McClain	M. L. Bauders	E. C. Daniel	350.8	5687	0.60	8.8
0.4 mi. E. of Peralta School—Gypsum Cr.	Sharp & Fellows	F. R. Pracht	G. H. Lamb	364.5	5624	.70	5.6
Cypress St. S. City Limits, Laguna Beach	J. E. Haddock	M. H. Mitchell	H. G. Johnson	425.8	5580	.77	12.5
Anaheim—Miraflores	C. O. Sparks	F. B. Cressy	T. A. Roseberry	309.5	4771	.89	9.5
1 mi. E. of Beaumont—Whitewater	Matich Brothers	C. V. Kane	F. H. Sherry	229.5	4500	2.24	12.7
Alabama St.—State St., Redlands	Geo. Herz & Co.	C. V. Kane	W. Ford	349.4	4634	2.40	6.2
Riverside Ave.—Colton	B. G. Carroll	E. A. Bannister	W. Crawford	398.0	4980	.36	10.5
			Averages	343.3	4965	0.93	9.3

ASPHALT CONCRETE PAVEMENT RECORDS FOR 1935

Location	Contractor	Resident Engineer	Street Assistant	Average tonnage laid per day	Average stability of surface mixture in lbs.	Per cent average relative specific gravity of surface mix	Roughometer index, inches per mile
Southerly Boundary—B St., Hayward	Jones & King	F. W. Montell	W. A. Marsh	325.0	2685	---	17.3
38th St. and Moss Ave., Market St.—Broadway	Peninsula Paving Co.	Geo. Mattis	W. A. Marsh	701.1	3000	92.1	15.7
Fell and 10th Sts., Van Ness Ave.—Bryant St.	Fay Improvement Co.	C. F. Price	G. L. Beckwith	263.1	2564	96.0	46.1
Bryant St., 5th St.—10th St.	A. J. Raisch	L. G. Marshall	W. Thomas	377.4	2725	94.4	19.8
Potrero Ave., Division St.—Army St.	Union Paving Co.	L. G. Marshall	W. Thomas	487.2	2720	95.2	15.8
Harrison St., 5th St.—10th St.	A. J. Raisch	L. G. Marshall	W. Thomas	518.0	3122	93.8	23.7
5th St., Harrison St.—Bryant St.	Chas. L. Harney	L. G. Marshall	W. Thomas	477.4	2900	96.0	29.1
Huron St.—San Pedro Ave., Daly City	Union Paving Co.	H. S. Payson	E. W. Herlinger	512.6	2775	93.0	21.9
Crystal Springs Road—Third Ave.	A. G. Raisch	C. F. Price	B. Allison	285.9	3000	91.2	51.0
College Ave.—S. City Limits, Santa Rosa	Union Paving Co.	A. L. Gladney	C. E. Ginner	378.0	3170	91.7	44.3
Selma—Fowler Switch Canal	Union Paving Co.	F. W. Howard	C. D. Willoughby	775.5	3062	94.8	25.0
Hanford—Easterly Boundary	Southern California Roads Co.	C. F. Oliphant	W. M. Nett	517.8	2863	92.9	17.6
In Madera	Union Paving Co.	F. W. Howard	C. D. Willoughby	683.9	3360	92.4	27.9
In Tulare	Basich Brothers	H. B. LaForge	W. M. Nett	556.6	2950	94.7	27.0
Visalia—Merryman	Basich Brothers	J. W. Cole	P. A. Boulton	390.8	3100	93.5	28.3
Sunset Blvd., La Veta Ter. Santa Monica Blvd.	Griffith Company	G. E. Farnsworth	A. W. Carr	273.2	3191	96.0	49.3
Newhall Tunnel—Saugus	Oswald Brothers	E. T. Telford	R. Cooley	531.3	3012	95.7	18.5
Ocean Ave.—Lincoln Blvd., Santa Monica	Griffith Company	L. R. McNeely	J. Upham, J. R. Rubey	490.2	3332	95.0	14.9
Monterey Park—Mountain View Road	Oswald Brothers	C. P. Montgomery	R. M. Olson	427.3	3875	---	18.9
Atlantic Blvd.—New Ave., Monterey Park	Griffith Company	C. P. Montgomery	R. A. Collins	604.8	3150	95.9	20.8
W. City Limits, Los Angeles—Beverly Blvd.	Los Angeles Paving Co.	E. L. Seitz	A. W. Carr	640.4	3212	94.8	28.2
Los Angeles Pumping Plant—West Channel Rd.	Griffith Company	P. E. Ruplinger	V. A. Miller	241.3	3450	91.8	33.1
Redondo Beach—Wilmington	United Concrete PipeCorp.	L. R. McNeely	A. W. Carr	624.0	2276	97.0	15.2
Alameda St.—E. City limits, Los Angeles	Oswald Brothers	H. B. Lindley	A. W. Carr	643.6	3117	96.5	19.8
W. City limits, Los Angeles—Wilmington Blvd.	Basich Brothers	F. B. Cressy	A. W. Carr	603.8	1935	93.4	19.4
Pacific Ave.—Olive Ave., Long Beach	Griffith Company	W. D. Eaton	E. C. Daniels	430.4	2627	93.3	47.0
Stanley Ave.—Loma Ave.	Sully-Miller Contr. Co.	W. D. Eaton	R. A. Collins	472.0	3508	92.8	13.4
Cerritos Ave., Los Angeles St.—Artesia Ave.	Oswald Brothers	W. J. Calvin	A. L. Hawkins	724.7	3203	96.8	11.1
State St.—Los Angeles Street	Sully-Miller Contr. Co.	W. J. Calvin	W. L. Hurd	635.2	2735	95.1	19.3
Prairie Ave.—Commercial St., Ingleside	United Concrete Pipe Corp.	L. R. McNeely	E. D. Davis	611.8	2800	98.3	14.9
Downey—Buena Park	United Concrete Pipe Corp.	E. A. Parker	K. D. Lewis	810.7	2770	95.4	15.8
Manchester Ave., Buena Park—Anaheim	C. O. Sparks	E. A. Parker	F. E. Bosch	419.0	2687	95.5	11.9
17th St., Anaheim—Fairhaven Ave.	Mundo Engineering Co.	H. B. Lindley	C. L. Aisthorpe	503.6	3150	97.3	16.2
Ventura—Mussel Shoal	Basich Brothers	W. I. Templeton	W. H. Hurd	712.1	3250	95.5	13.7
Seacliff—Benham	Basich Brothers	W. I. Templeton	A. W. Carr	512.1	3505	93.1	17.5
I St., bet. W. and E. City Limits, Colton	Griffith Company	J. M. Hollister	W. Ford	499.9	2857	97.5	16.8
San Antonio Ave.—E. City Limits	C. O. Sparks	J. M. Hollister	B. Nelson	385.6	3130	97.6	38.8
South Broadway—R Street, Merced	Valley Paving & Const. Co.	G. R. Hubbard	E. W. Ray	237.2	3590	95.0	33.1
French Camp—Stockton	Heafey-Moore Co. & J. A. Casson	A. K. Nulty	R. H. Lapp	448.6	3200	94.8	24.5
At Fresno Ave grade separation, Stockton	Heafey-Moore Co.	A. K. Nulty		204.0	2700	92.6	45.0
Emerald Ave.—E. City limits, El Cajon	V. R. Dennis Const. Co.	L. E. Liston	L. E. Crayne	326.2	4209	95.6	28.9
			Averages	520.5	2908	95.0	21.1

BITUMINOUS TREATED SURFACE RECORDS FOR 1935

Location	Contractor	Resident Engineer	Roughness, inches, per mile
Plant Mix			
3 mi. N. of Willows—Orland	Tiffany Construction Co.	J. D. Greene	31.9
South City Limits—Main St., Woodland	A. Teichert & Son	W. G. Remington	43.7
In Hayward and San Leandro	Lee J. Immel	F. W. Montell	46.3
Napa—Greenwood Corner	E. A. Forde	E. Carlstad	30.3
Thornton—Daly City	Peninsula Paving Co.	W. A. Rice	36.7
Coarse Gold—Oakhurst	A. Teichert & Son	J. W. Cole	47.9
1.5 mi. N. of Moreno——2.5 mi. W. of Beaumont	Mittry Brothers	H. O. Regan	24.2
1 mi. E. of Beaumont—Whitewater	Matich Brothers	C. V. Kane	69.9
Martell—Jackson	J. R. Reeves	A. K. Nulty	32.8
Through Fairfield	Pacific States Const. Co.	G. R. Hubbard	59.5
4 mi. W. of Shavers Summit—Shavers Summit	Oswald Brothers	R. C. Payne	35.2
Approaches Escondido Creek Bridge	Sharp & Fellows	W. T. Rhodes	21.7
Hill St., Wisconsin Ave.—8th St.	Southwest Paving Co.	W. T. Rhodes	21.8
		Average	36.0
Road Mix			
Court St.—California St., Redding	Hemstreet & Bell	M. Fredericksen	65.1
North entrance to Redding	T. M. Morgan Co.	M. Fredericksen	34.9
South entrance to Red Bluff	Hemstreet & Bell	G. Sundman	91.0
At Ogleby Canyon	M. J. B. Construction Co.	W. G. Remington	38.8
Hollister Ave.—Painted Cave Road	Granfield, Farrar & Carlin	V. E. Pearson	14.8
Route 2—San Juan Bautista	A. J. Raisch	J. C. Adams	23.2
West Boundary—2.4 mi. S. of Maricopa	C. W. Wood	W. T. Rhodes	22.0
4 streets in Maricopa	C. W. Wood	W. T. Rhodes	28.5
1 mi. E. of Taft—½ mi. W. of Taft	D. O. C. Const. Co. & R. D. Paterson	T. W. Voss	21.9
1.5 mi. S.—4 mi. E. of W. Waterworks Pump Sta.	Basich Brothers	H. B. LaForge	19.5
5.5 mi. E. of Llano—Camp Cajon	Geo. Herz & Co.	E. A. Bannister	46.2
1.8 mi. S.—0.9 mi. S. of Fish Springs School	Tiffany Construction Co.	A. P. McCarton	22.6
¾ mi. S. of North Bdy.—North Bdy.	Tiffany Construction Co.	A. P. McCarton	22.2
1 mi. N. of Bodie Road—Point Ranch	Kennedy Construction Co.	A. P. McCarton	42.0
Centerville Bridge—Markleeville	Frederickson & Watson	A. L. Tschantz-Hahn	55.2
Nevada State Line—3.4 mi. N. of Woodfords	Frederickson & Watson	A. L. Tschantz-Hahn	40.3
0.8 mi. N. of Newman—0.2 mi. S. of Crow's Landing	Union Paving Co.	A. N. Lund	51.4
Indio—Shavers Summit	Frederickson & Watson	E. L. Evans	46.4
Lake Hodges Dam—Rancho Santa Fe	Sharp & Fellows	E. L. Evans	29.0
Through the Narrows	Dimmitt & Taylor	C. R. Hogberg	46.4
1 mi. E. of Barrett—Tecate Road	Daley Corporation	B. F. Moore	81.8
		Average	37.0
Miscellaneous Types			
Oregon Mountain—Oregon State Line	E. B. Bishop	C. W. Backe	172.5
1 mi. E. of Upper Lake—Manila Ranch	Hemstreet & Bell	H. C. Amesbury	88.5
In Ukiah and Willits	E. A. Forde	W. W. Compton	132.5
2.8 mi. N. of Junction Rte. 21—State Line	Harms Brothers	L. H. Williams	80.0
Near Steamboat Slough	Lee J. Immel	J. P. Murphy	49.5
Ryde—½ mi. E. of Steamboat Slough	Lee J. Immel	J. D. Greene	48.0
3 mi. E. of Half Moon Bay—Summit	Mittry Brothers	H. A. Simard	37.8
Military Reservation—Cannon Street	V. R. Dennis Co.	J. M. Hodges	67.6
		Average	102.0

BITUMINOUS TREATED SURFACES

While the plant-mix type of oiled surface predominated during 1934, in 1935 the road-mix type gained in popularity, about 84 miles being constructed against 38 miles of plant-mix. There were also constructed under supervision of the Construction Department about 24 miles of seal coat, 4.2 miles of retread, and 1.9 miles of bituminous macadam.

The record for **surface smoothness** for **plant-mix** type, 2.7 inches per mile, was made on Contract 611VC8, in San Diego County, approaches to Escondido Creek Bridge; contractor, Sharp & Fellows, and resident engineer, W. T. Rhodes. The average roughness index for the State during 1935 was 36 inches, compared to 26.4 inches in 1934.

For **road-mix** type, the smoothest surface was obtained on Contract 65XC3-45CS3 with 14.8 inches per mile, in Santa Barbara County, Hollister Avenue to Painted Caves Road. Granfield, Farrar & Carlin were the contractors, with V. E. Pearson as resident engineer. The State average was 37 inches, compared to 27.3 inches in 1934. The average smoothness of the **miscellaneous** types was 102 inches per mile, compared to 47 inches in 1934.

GLAD TO BE CALLED

Willingness of Maintenance Department men to answer calls at any time is illustrated by a story told by Maintenance Engineer E. T. Scott. The Los Angeles sheriff's office phoned Scott that a truck had broken a hole through the deck of the Olive Street Bridge across the Los Angeles River on Route 167 (Atlantic Boulevard). To make sure that the situation was taken care of immediately, Scott telephoned the two foremen nearest the bridge. One was Foreman Louis Knecht.

"After I had given Knecht his instructions," Scott reports, "he thanked me for the assignment, saying he was glad to be called."

Highway Planting at Entrance to City of Redlands

By B. A. SWITZER
Assistant Engineer

A FEW months ago the State completed the construction of a new westerly entrance to the city of Redlands on Central Avenue. Upon the completion of the new entrance, the city beautification committee, cooperating with the city planning commission, requested landscaping of the right of way.

A study of the new entrance indicated that the principal problems would be to screen an old city dump, certain industrial sections, including railroad yards, gas storage tanks, and other commercial and industrial structures.

It was decided to plant Sydney wattle (*Acacia longifolia*) along the edge of the borrow pit, interplanting with sugar gums (*Eucalyptus corynocalyx*). This same planting was continued along the railroad on the north side of the highway. Opposite the railroad yards and east of the borrow pit the eucalyptus were interplanted with Australian tea trees (*Leptospermum laevigatum*) which tend to soften and obscure unsightly industrial buildings and structures.

ROADSIDE PARK DEVELOPED

Near the westerly city limits and across from the dump was a wide three-cornered area. This area has been planted to serve as a small roadside park. Large and flourishing pepper trees already growing there were taken advantage of and the landscaping was designed about them. In this area it was found possible to plant California Holly (toyon), whose deep greens are set off by brilliant red berries during the holiday seasons. As a contrast to the toyon, desert trees (Palo Verde) were planted. The name of this tree is Spanish for "Green Stick" evidently given it because of its scarcity of leaves and because the limbs and twigs are a pale green. But in spite of its lack of foliage, during the Spring it presents a beautiful show of yellow blooms. Additional trees planted for shade will some day make this an attractive and pleasant place.

The part of the highway in the business section of the city was planted to Cocos palms (*Cocos plumosa*). This is a continuation of a palm planting which has already been extensively carried out throughout the business section of Redlands.

BRILLIANT GROUND COVER

On the easterly end of the project, the highway passes through a semi-residential area; on this section, palm planting was continued, but they were interplanted with the purple-leafed cherry plum (*Prunus pissardi*), with a ground cover of Mesembryanthemum Croccum.

The ground cover is already making a brilliant show of green to the passing motorists and exciting comment from those who note the red and bronze colored flowers.

Funds for the project were allotted by the Federal government from the one per cent of Federal funds assigned to highway beautification and roadside improvement.

The beautification of the new Central Avenue entrance to Redlands will be in keeping with the many other tree- and palm-lined avenues throughout the city.

Increase in Car Owners Greatest in Golden State

California last year led all states in the greatest numerical gains made in car ownership and also had the greatest density of car ownership with a ratio of one car for every 2.62 persons, according to reported figures in a nationwide study of automobile registration totals.

Ownership of motor vehicles in California increased 145,246 cars in 1935. Ohio was second with an increase of 98,786. New York continued to head the list as to the aggregate number of motor vehicles registered, with a total of 2,330,962, but was closely followed by this state with a total of 2,280,485. Nevada boasts one car for every 2.84 persons.

At the close of last year there were 26,221,052 motor vehicles registered in the United States, or one for every 4.86 persons. This was an increase of five per cent over the preceding year and, with the exceptions of 1929 and 1930, was the highest in motoring history.

Gov. Merriam to Open Bay Bridge Nov. 12th

(Continued from page 2)

total length of 8500 feet of interlacing viaduct, and sixteen separate grade crossings.

It is really a twin structure of roads for incoming and outgoing bridge traffic.

Large illuminated signs "To Oakland," "To Alameda," "To Berkeley," et cetera, will seek to guide the motorists to their proper designations, although the structure is so logical that about all that is necessary is to "follow one's nose."

FREE PARKING AREA

Motorists entering or leaving San Francisco over the bridge may proceed from the Fifth Street Plaza, near the heart of the shopping district, up the mile-long main approach. Or they may leave the bridge over a curving ramp just west of the San Francisco anchorage, Clementina at First Street in lower downtown San Francisco. They may enter the bridge from this district over another curving ramp from Fremont at Harrison.

Trucks and buses enter and leave over an approach entering the lower deck from a point on Harrison Street between Sterling and Rincon or at Folsom and Essex Streets.

To further facilitate the traffic problem on the San Francisco side, parking areas will be provided for the use of those using the bridge under the main approach. The space is sufficient to accommodate from 1500 to 2000 automobiles. The parking space will be paved and fenced. Motorists desiring to park here will indicate their intention as they pay their fare at the toll gate and will be given a parking ticket.

OBSOLETE, NOT ABSOLUTE

"My word is law, I'll have you know"—
The husband thus discoursed.
"I know it," sweetly said his wife—
"A law that's not enforced."

"He was kicked out of school for cheating!"
"How come?"
"He was caught counting his ribs in a physiology exam."—Gargoyle.

Friant Dam Plans Approved-- New Impetus Given Water Project

IMPETUS was given to work on the Central Valley Project on September 22 when the Water Project Authority of California, at a meeting attended by John C. Page, Acting U. S. Commissioner of Reclamation, and other Federal officials, approved the general plans for Friant Dam at Friant, important unit of the Central Valley Project.

Encouragement was given to Director of Public Works Earl Lee Kelly and State Engineer Edward Hyatt by Mr. Page, who said that while the question of future appropriations for the project rests with Congress the official attitude in Washington at present is exceedingly friendly, and he expressed his confidence that the great undertaking will be pressed to completion.

Mr. Page was accompanied to the meeting, which was held in Sacramento, by E. K. Burlew, Administrative Assistant, United States Department of Interior; Richard J. Coffey, District Counsel, Bureau of Reclamation, and Walker R. Young, construction engineer in charge of the Central Valley Project.

BUREAU PLANS APPROVED

Prior to coming to Sacramento, Commissioner Page, on a tour of western reclamation projects, was met at Redding by State Engineer Hyatt, Mr. Young and State Senator John B. McColl of Redding and with them inspected the Kennett Dam site and the proposed Pit River crossing combination highway and railroad bridge. The party inspected the Orland Project on September 21 and then came to the Capital City for a conference with the Water Project Authority.

At this meeting the Authority approved the general drawing submitted by the U. S. Bureau of Reclamation entitled "Plans—Elevation and Sections"—of Friant Dam, in accordance with the contract entered into between the United States and the Authority on March 25, 1936, requiring the approval by the Authority of all general plans of project works.

Words of Praise for the Central Valleys Project

John C. Page, acting reclamation commissioner, has commented that the Central Valleys Project will benefit more people and do more good than any other project undertaken by the federal government.

The statement is not an exaggeration.

The project is not alone a plan to produce more power, although power is a most important item. The water that will flow through the turbines at Kennett Dam will only have started on its long course of usefulness. Coming down the river it will be scouring out out sand and silt and restoring navigation conditions which have not existed for fifty years.

In the delta it will shove back salt water that gradually has been encroaching on some of the richest lands in the United States.

Finally, it will be pumped up the San Joaquin River to be spread into irrigation canals and ditches and provide moisture for growing crops.

The project's usefulness will not end with the disposition of the waters to be stored at Kennett Dam. The Friant Dam and the system of canals that will carry water to a half million acres in Tulare County will save a vast area from reverting to desert.

It is difficult to conceive of a like project the benefits of which would reach so many people.

California is gratified that a federal official of such high standing as Page has given recognition to these benefits.—*Sacramento Bee.*

The dam is to be located about one mile up stream from the town of Friant at a stream bed elevation of 308 feet above sea level.

$15,000,000 FUND AVAILABLE

During a general discussion of the problems confronting the Central Valley Project, it was stated by the commissioner that approximately $15,000,000 are now available for work on the undertaking.

President Roosevelt, on September 10, 1935, allocated $20,000,000 to the Bureau of Reclamation from the Emergency Relief Appropriation of 1935, for the purpose of starting work on the project. On November 16, 1935, by executive order, this appropriation was reduced to $15,000,000 and, owing to the need for drought relief funds in the Middle West, later was reduced to $8,100,000.

The last Congress, in the First Deficiency Bill, appropriated $6,900,000 for continuance of the project, to remain available until June 30, 1937, with the provision that $6,000,000 be used for construction of Friant Reservoir and irrigation facilities therefrom in the San Joaquin Basin.

FURTHER APPROPRIATIONS EXPECTED

There is apparently available now, therefore, $15,000,000 for the construction of the project, which is estimated to cost $170,000,000. It is assumed that the funds advanced will be reimbursable under the terms of the Reclamation Act by repayments without interest over a period of 40 years.

Under House Resolution 6732, adopted by the last Congress, a special direct contribution of $12,000,000 by the Federal government to the cost of Kennett Reservoir was authorized in accordance with the recommendation of the Chief of Engineers of the United States Army, which was contained in House Rivers and Harbors Document No. 35, Seventy-third Congress, second session. It is expected that continuing congressional appropriations will be made to complete the project as rapidly as the construction program necessitates.

The site of Friant Dam is in Fresno and Madera counties, about 20 miles



Friant Dam Site on the San Joaquin River 20 Miles East of th

DOTTED LINE SHOWS WHERE STRUCTURE WILL EXTEND ACROS



Official group at State Water Project Authority Meeting in Sacramento. Front row, left to right: Edward Hyatt, State Engineer; Spencer Burroughs, Attorney; Walker Young, Construction Engineer, U. S. Bureau of Reclamation; Harry Barnes, J. A. Secara, and T. S. Coffee, Madera District. Rear Row: A. B. Tarpey, Fresno District; R. J. Coffey, U. S. Reclamation Bureau; U S. Webb, Attorney General; Public Works Director Earl Lee Kelly; John C. Page, Acting Commissioner, U. S. Reclamation Bureau; A. E. Stockburger, Director of Finance; Chas. Kaupke and W. T. Boone, Kings River Association; J. R. Fauver, Tulare Association; M. T. Farmer and L. B. Hayhurst, Fresno District; C. C. Carleton, Chief, Contracts and Rights of Way.

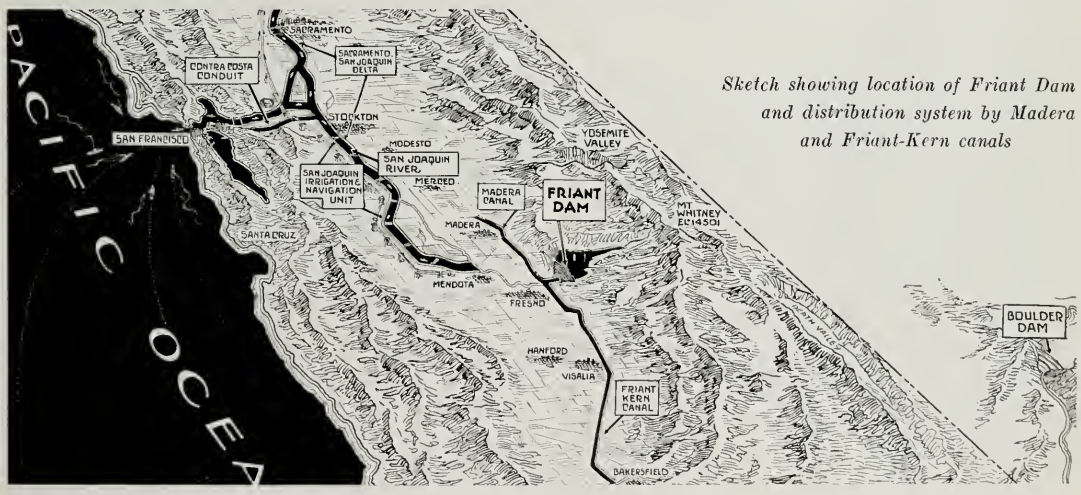
east of the city of Madera and 20 miles northerly from the city of Fresno.

The dam will provide primarily for the conservation and regulation of the tributary run-off of the San Joaquin River and diversion of San Joaquin River water to the upper San Joaquin Valley to meet the needs therein of



ty of Madera and 20 Miles Northerly From the City of Fresno

EAM BED WITH LENGTH OF 3400 FEET AND HEIGHT OF 260 FEET



Sketch showing location of Friant Dam and distribution system by Madera and Friant-Kern canals

imported water supplies now necessary.

A concrete gravity type structure straight in plan, across the stream channel, is proposed, with a maximum height above stream bed of 260 feet and a crest length of 3400 feet.

An overflow spillway is provided at the center. Spillway controls consist of three drum gates 18 feet high by 100 feet long, having an estimated combined discharging capacity of 90,000 second-feet.

A set of irrigation outlets is to be located on each side of the river: outlets for the Madera Canal on the north side at an elevation of 446 feet with discharging capacity of 1500 second-feet; and outlets for the Friant-Kern Canal on the south side at an elevation of 464 feet with discharging capacity of 3500 second-feet.

Outlets are also provided near the stream bed to be utilized for release of lower San Joaquin crop land water until the San Joaquin pumping system is constructed and a complete exchange of supplies effected. A regulatory flood control outlet is provided for by the construction of six outlets through the dam near stream bed.

At flow line elevation of 563 feet, the reservoir will have a gross stor-

(Continued on page 29)

Westerly Approach to Capital City Reconstructed as Multi-lane Arterial

By E. J. L. PETERSON, Assistant District Office Engineer

WIDENING and resurfacing of the section of the State highway between the Yolo causeway and the M Street Bridge, west of Sacramento, approximately 3½ miles in length, is expected to be completed before the end of this month. Paving was finished on October 7.

This project improves the heavy traffic routes U. S. 40 and U. S. 99, west, and provides a three-lane highway for the westerly approach to Sacramento. The easterly terminus of the project is about one-half mile west of the beautiful Tower Bridge recently completed over the Sacramento River. The westerly terminus of the project is the Yolo causeway, which was widened to 42 feet in 1933 to accommodate the increasing traffic on this route.

During construction maintenance of public traffic was a serious concern on this heavily traveled road. No practicable detours were available and provision had to be made for routing a continuous stream of automobiles and trucks—that at times reached an hourly total of between 400 and 500, 10 per cent of which were trucks—within the right of way. A temporary road, alongside the existing pavement, was graded and surfaced 3 inches thick and to a width of 22 feet to adequately care for the heavy units and dense volume of traffic. The route of the temporary road was crossed from side to side to avoid destruction of some very fine trees and improved driveways.

TEMPORARY SURFACE SALVAGED

As full sections of the asphaltic concrete pavement were completed public traffic was routed over it. The temporary road surfacing is to be salvaged and used in the construction of 4-foot borders on each side of the new pavement and for surfacing road approaches.

This project required aproximately 51,000 cubic yards of imported borrow. The grading required about 22,000 cubic yards of unclassified material. The paving will require 23,500 tons of asphaltic concrete.

Landscaping of the approach to the Tower Bridge has been recently completed and planting is proposed on this project to augment the landscaping at the bridge, thereby providing a beautiful aproach to the Capital City.

The reconstruction of this highway will represent an expenditure of approximately $168,000. It is being financed from the State highway funds and Federal funds under control of the United States Bureau of Public Roads. J. D. Greene is the Resident Engineer for the State. A Teichert & Son, Inc., is the contractor.

OLD ROAD BUILT IN 1916

The old road, constructed in 1916, consisted of an 18-foot by 5-inch Portland cement concrete pavement with an oiled surface. Oil-mixed borders 2 feet wide were subsequently constructed on each side of the pavement. The pavement had reached the stage of obsolescence and was requiring increasingly costly maintenance. Several sections which had been blanketed to provide a suitable surface for traffic were beginning to show signs of disintegration.

Funds for the reconstruction of this section were provided in the budgets for the 87th-88th fiscal years and the contract was started on June 10.

The new road is graded to the right of way lines and provides for a 56-foot roadbed with a 40-foot asphaltic concrete pavement for a length of aproximately one-quarter mile at the westerly end of the project; the remainder of the project being on a 46-foot roadbed with asphaltic concrete pavement 30 feet wide.

The position of the new pavement with respect to the right of way lines and the crown of the pavement is such that development of the 30-foot pavement to a 40-foot width can be readily effected. This has been achieved by establishing the construction center line in the middle of the 100-foot right of way and constructing a 20-foot width of pavement on one side of the construction center line and a 10-foot width on the other with the pavement sloping transversely from the center line.

The 40-foot pavement was constructed in two 20-foot widths and the 30-foot pavement was constructed full width. Where the pavement is on new subgrade the typical section is standard with 0.6 of a foot thickness at the center, increased to 0.75 of a foot thickness at the edges. Where the old pavement is being resurfaced the minimum thickness over the existing pavement is 0.33 of a foot.

SELECTED MATERIAL BLANKET

The major portion of the native soil on this project consisted chiefly of adobe having a high shrinkage value which made it necessary to provide a subgrade treatment of selected material to form a cushion course between the new pavement and the native material. At other locations where the existing pavement was badly broken, a cushion course was also placed between the new pavement and the old pavement. The selected material blanket underneath the new pavement was constructed approximately 1 foot in thickness and extends for the full width of the roadbed.

Over the greater portion of the project the old Portland cement concrete pavement was utilized as a base for the new asphaltic concrete pavement. The subgrade was specially treated at the edge bordering the Portland cement concrete pavement base where the asphaltic concrete pavement was designed to be placed over and adjacent to the base. The earth subgrade was first given the standard treatment after which, at the edges of the old concrete base, a

(Continued on page 22)











Reconstruction of the Sacramento-San Francisco arterial between the Tower Bridge entrance to the Capital City and Yolo Causeway will be completed this month. Widening and surfacing to provide three and four lanes paved with asphaltic concrete is progressing rapidly while heavy traffic is enabled to proceed over a surfaced by-pass within the right of way. Upper right picture shows narrow old road.

All-color Motion Picture of Highways Has Premiere

ACCLAIMED by movie critics as one of the most beautiful all-color motion picture travelogues ever produced, "California Highways," depicting the progress of road building in this State from the days of the Franciscan mission padres to the present time, had its premiere showing at the Alhambra Theater in Sacramento on the night of October 6 before two capacity audiences.

Conceived as a means of informing the people of California of the splendid system of State highways that has been made possible by the bond issues they have voted and the gas tax which they willingly pay, the picture was made by the Division of Highways with the approval and cooperation of Governor Frank F. Merriam and Earl Lee Kelly, Director of the Department of Public Works.

Even before its first showing, word of its production had spread afar and numerous requests for its display in other states have been received by the Department of Public Works, so that in addition to its educational and informative value to Californians it already has become an asset of great potential possibilities in advertising to the world the scenic and highway attractions of California.

TWO PREMIERE SHOWINGS

Two large audiences, the first composed of State, county, municipal and highway officials and invited guests from every section of California and the second of the public generally, which was admitted free, witnessed the premiere.

Photographed in colors, the beauty spots of the Golden State which may be seen from State highways make a film of unrivaled charm. The scenes pictured range from rugged mountain regions to the desert country of southeastern California and present a variety of topography unequaled in this country.

The picture does not overlook the industries and progress in town and city building made posisble by the State highways so vividly portrayed in color.

To an attentive audience, Director Kelly explained the purpose of the film and added that he wanted to publicly express his appreciation of the work done by three men of his department who had made possible the taking of the picture—Deputy Director of Public Works Edward J. Neron, J. G. Standley, Principal Assistant Engineer, and Merritt Nickerson, Department Photographer.

WORTH WHILE, SAYS GOVERNOR

The introduction of other speakers he delegated to Pat West, Hollywood movie comedian, who acted as master of ceremonies. Brief talks commending the State officials responsible for the production of "California Highways" were made by Mayor Arthur Ferguson of Sacramento and A. J. Affleck, president of the Sacramento Chamber of Commerce. Carroll H. Dunning, of the Dunning Color Process Co. of Hollywood, who directed the picture, extolled the scenic attractions of the State as shown in the film and urged all Californians to take advantage of their highways to visit the places pictured. Following remarks by C. H. Purcell, State Highway Engineer, Governor Merriam was introduced.

The Governor said the question had been raised whether it had been worth while to devote four months to the making of the picture.

"It was worth while," he said, "because this film will show Californians what becomes of the gas taxes they pay. It was worth while because this film will attract thousands of tourists to this State. It was worth while because many states already have asked that we loan the picture to them for showing. Decidedly, it was worth while to make this picture."

Hollywood sent three of its most promising young movie actresses to the premiere in the persons of Judith Barrett, Muriel Robert and Thelma Byron. They received the plaudits of the audiences.

SCENES TOTAL 355

The film consists of 355 separate scenes, the first of which reproduces conditions confronting the Franciscan friars when, under the zealous guidance of Father Junipero Serra, they began their treks from San Diego north to San Francisco over footpaths and trails that were to become in time El Camino Real—the King's Highway.

A Franciscan monk and his burro are shown plodding their weary way over El Camino Real, primitive beginning of what today is one of the greatest highway systems in the world—California's vast network of paved highways.

The padres passed on, leaving their missions behind them, and their places were taken by the miners and pioneer settlers of '49, and the inevitable stage coach and methods of travel in those turbulant times are depicted by the film.

Then follow the horse and buggy days and horse-drawn vehicles traverse dusty California roads. Progress triumphs again and the first automobile makes its appearance. By 1910, more than 36,000 cars were using dirt roads, which steadily were getting worse while rapid strides were being made in the manufacture of improved and faster automobiles. These roads the picture shows.

EXPANDED WITH GAS TAX

And then in 1910 came the awakening of Californians to the need of good highways and they voted the first highway bond issue, following this action by approving of a second bond issue. In 1923 came the imposition by the legislature of the first gas tax and the expansion of the State highway system begun in 1912 is graphically shown by the film.

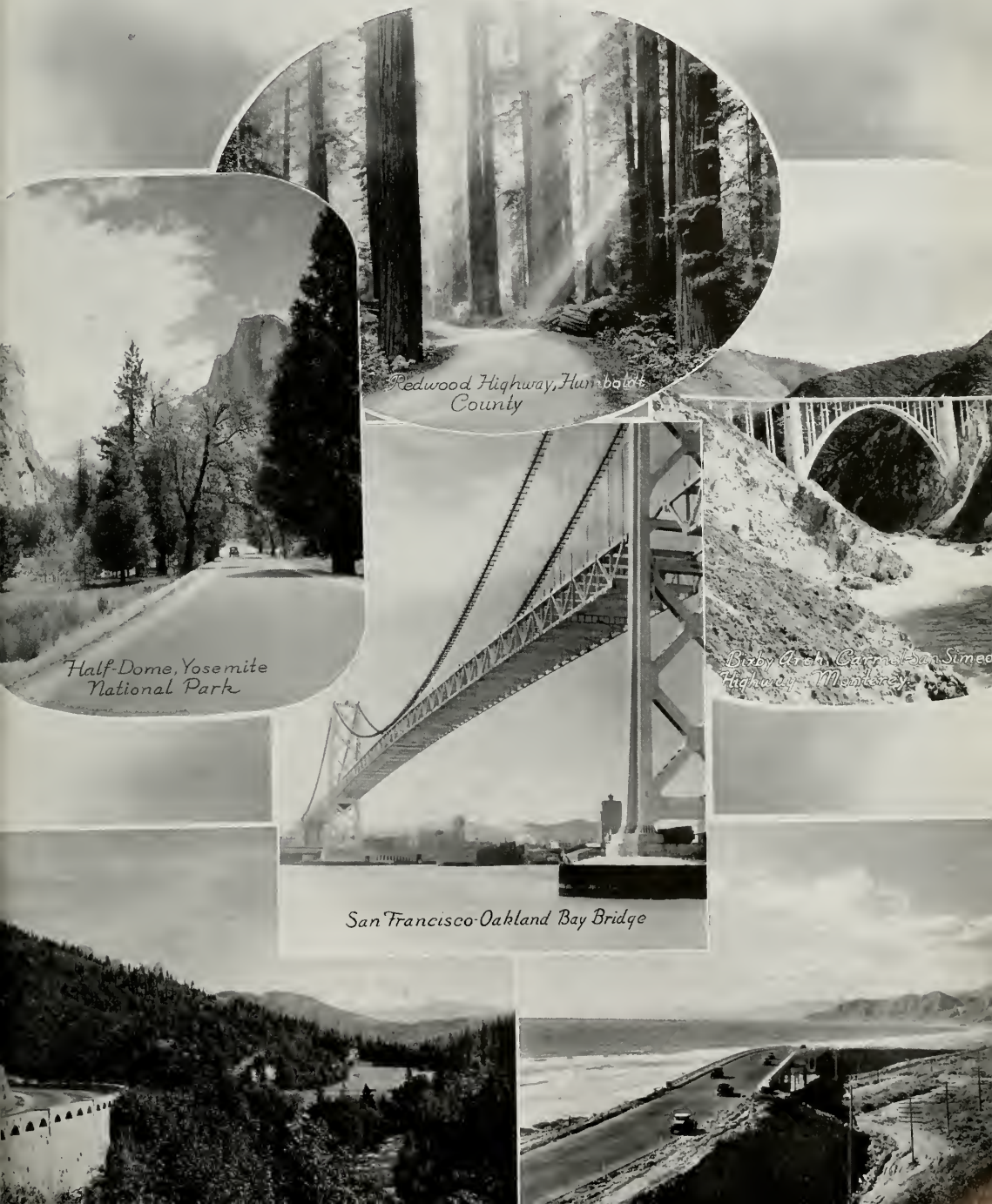
The producers of the picture traveled over 11,000 of the 14,000 miles of the State Highway System. Beginning at Donner Summit, the film takes a viewing audience in imagination throughout the length and breadth of California.

There are beautiful views of Donner Lake and the massive bridge of architectural beauty which the Divi-

(Continued on page 22)

SCENES from "CALIFORNIA HIGHWAYS"

Motion Picture in Color



From Mountains to Desert by Highway Picture Travelogue

(Continued from page 20)

sion of Highways erected over a great gorge nearby; of Lake Tahoe, Emerald Bay and Lake Topaz; of Mono Lake and Leevining Grade, to only eastern approach to Yosemite. Maintenance crews of the Division of Highways are shown with their rotary plows and equipment clearing mountain roads of thousands of tons of snow.

From snow-capped ranges the film suddenly transports one to the desert lands in the south where the Yucca flower and Joshua trees provide a startling contrast. Here the desert sands have been conquered by engineers of the Division of Highways and excellent roads attract tourists even in the middle of summer.

GRADE CROSSING IMPROVEMENT

Then the film changes to show what has been done to eliminate hazardous railroad crossings by the construction of underpasses and overpasses and quite suddenly whisks one to Lake Arrowhead, high in the mountains of San Bernardino. Here, as at Lake Tahoe and Donner Lake, Nature's lavish colors lend enchantment to the picture.

Modern sections of highways with the various road signs for the protection of motor and pedestrian traffic are shown in scenes taken at Santa Ana, Santa Monica, Los Angeles and other southern California points, where automobile traffic is exceedingly heavy. There are shots of Hollywood Boulevard, the beaches and beach highways of Los Angeles, San Diego Bay, across which lies Coronado, famous playground, all of which reveal how the modern highways of the State handle the congested traffic that uses them.

The oil fields of Los Angeles, which supply the new product for the extraction of the gasoline on which is levied the tax that provides Californians with their highways are shown. There are scenes on the new Ridge Route, in Altamont Pass, in Sequoia National Park, in Kings River Canyon, where a new State highway is being built; in the Merced River Canyon and in Yosemite National Park.

HISTORIC MOTHER LODE SCENES

The Yosemite scenes are particularly beautiful. From Yosemite it is a natural jump to the Mother Lode country, to the cabins of Mark Twain and Bret Harte and to the old mining towns through which now run paved State roads.

Scenes along the highways in the Mt. Lassen, Mt. Shasta and Shasta River gorge country are delightful color studies.

The film devotes much attention to the bridges built by the State on its highways and shows the new Sixteenth Street Bridge and Tower Bridge in Sacramento; the Eel River span on the Smith River near the State's northern boundary; and the bridges along the route of the Feather River Highway now approaching completion, only a few of California's thirty-five hundred highway bridges.

The Redwood Empire highways, Clear Lake and the highways of Lake County, the San Francisco Bay cut-off and the Sky Line Boulevard from San Francisco south; the Dumbarton underpass, the incomparable coast line of Monterey County with Carmel Mission, Del Monte, the Bixby Arch, highest bridge structure on the State Highway System; Cuesta Grade in San Luis Obispo County and many other equally interesting scenes go to make up a fascinating picture travelogue.

Numerous shots of wild flowers along California highways and in fields bordering them are shown together with examples of highway beautification work performed by the Division of Highways in the way of flowers, shrubbery and trees planted alongside State roadways, and drinking fountains erected at suitable points for the use of thirsty motorists.

Excellent views of the San Francisco-Oakland Bay Bridge and the Golden Gate Bridge are shown. The magnitude of the former structure, largest of its kind in the world, is revealed in the film, which takes in the major points of interest on this great undertaking, which will be dedicated and thrown open for automobile traffic on November 12.

"California Highways" is indeed a remarkable picture. The Department of Public Works plans to have it widely shown in this and other states so that Californians may become better acquainted with their priceless highway possessions and in order that the entire country may come to know more of the scenic beauties of the Golden State and their easy accessibility made possible by the most modern of highways.

CAPITAL CITY APPROACH

(Continued from page 18)

layer of coarse rock 6 inches wide and 2½ feet thick was spread and rolled into the earth subgrade until it became flush with the designed subgrade section.

This edge is a critical point because adequate scarifying, blading, mixing and rolling of the subgrade at the edges are almost impossible to achieve. This treatment tightened the subgrade at this critical point and increased the bearing power so that it was more nearly equal to that on the remaining portion of the subgrade.

AUTO REGISTRATIONS IN CALIFORNIA TOTAL 2,352,771

An increase of nearly eight per cent in automobiles registered in California on August 31, 1936, as compared with the same period in 1935, is shown in a report by Ray Ingels, Director of the State Motor Vehicle Department, to Governor Frank F. Merriam.

Registration of all classes of vehicles increased 179,707 during this period, as compared with the same period last year, total registration being 2,352,771 as against 2,171,322 in August, 1935.

Licenses issued to dealers for this period also gained, dealers' trailer licenses leading the way with an increase of 66.67 per cent, caused, officials believe, by the camp trailer vogue.

"I see where Jones is advertising a new kind of underwear without any buttons."

"I've been wearing that kind for years."

Freddie Frosh: "Darling, I love you as no one ever loved before."

College Widow: "Humph! I can't see any difference."

Construction and Pavement Records for 1935

(Continued from page 11)

perimenting was carried on to improve old established methods.

One of the most difficult tasks in resurfacing jobs is to spread the proper amount of asphalt mixture in front of the finishing machine to insure that it is not at times carrying an excess which has to be carried ahead by hand, or that it is running with a deficiency of mixture which again calls for hand work.

Two types of spreading devices were developed for this purpose. One consisted of V-type drag with blades adjustable for height, built by Basich Bros. The other device was a screw conveyor type of spreader with screws reversing at the center and conveying toward each side form with an adjustable strike-off behind the screw designed by the United Concrete Pipe Corporation.

Both of these devices ride on the side forms and are operated just in advance of the finishing machine. The mixture is dumped through a spreader box riding on the base or tail-gated from a truck in front of the spreaders. These spreaders reduce to a minimum the amount of hand labor required in front of the finishing machine and eliminate entirely the necessity of tramping over the uncompressed mixture.

Finishing machines are now being manufactured in California and in many respects they are superior to any machine manufactured in the east.

The three-axle roller has been given a trial on a number of projects this season and the results have been very gratifying. This type of roller will not produce the riding surface demanded in California without the addition of supplemental cross-rolling with a tandem roller, but they do reduce the amount of this cross-rolling to the extent that one tandem can handle the normal day's run.

The specifications have been strengthened in regard to plan operation, tending to improve control of mixtures. Dust collectors are a requirement. Driers must be fed by blending belts and fine aggregate fed to the belt by means of automatic feeders, mixers must be equipped with timers, and driers must be provided with pyrometers to aid in heat control.

Highway Project and Bridge Bring Coast Nearer Capital

Completion of the new bay bridge and of three highway projects will bring downtown San Francisco within two hours of Sacramento.

The realization of this dream of rapid transit is but one example of the tremendous undertakings, now commonplace, in the fight to save a few minutes' time in travel. The projects referred to cost millions; only about 11 miles is saved in the distance between the bay cities and the state capital. But that 11 miles taken from the schedules of thousands and hundreds of thousands of travelers, commercial operators, business men, state officials, will pay for itself many times over. This is the theory of modern road building.

The highway projects which will shorten the distance between Sacramento and San Francisco include the straightening of the road west of Vacaville, the American canyon cutoff and the new East Shore highway, which will route the traveler away from several towns and much of the congested district of Oakland. A campaign of straightening the existing curves along these highways will later be entered upon, and this is expected to clip off another four miles at least.

The bridge and the highways will be completed by November 12. That will be a red letter day in travel annals. It will mark the inauguration of great new conveniences in transportation between here and the coast.—*Sacramento Union.*

Last Grapevine Canyon Unit Completed

(Continued from page 8)

Angeles County, was completed in October, 1933. Traffic counts on this road from 1932 to 1936 indicate the importance of this highway and reveal the steadily increasing use of it by motorists. Here are the counts:

	Sunday	Monday
July, 1932	2641	2317
July, 1933	2857	2316
July, 1934	4177	2976
July, 1935	5099	3672
July, 1936	4786	4699

The extent of the improvements resulting from reconstruction of the three units from the Los Angeles County line to the foot of the Grapevine is shown by the following comparison of the old and new work:

	Old Road	New Road
Maximum Grade	6.0%	6.0%
Adverse Grade	2153 lin. ft.	650 lin. ft
Number of Curves	119	23
Minimum Radius Curve	80' (2 curves)	1000' (2 curves)
Maximum Radius Curve	2000'	10000'
Total Curvature in degrees	4300° 30'	576° 56'
Curvature in Equivalent Full Circles	11.9	1.6
Length	11.91 mi.	10.71 mi.
Distance Reduced by the Improvement is		1.2 mi.

The cost of the entire project, the three units of which were constructed by one contractor, Griffith Co., was approximately $1,270,000, summarized as follows:

	Cost Moving Utilities	Construction Cost	Total Cost
Unit 1	$90,014.06	$404,740.97	$494,755.03
Unit 2	47,472.38	371,751.92	419,224.30
Unit 3	26,565.38	328,837.56	355,402.94
Totals	$164,051.82	$1,105,330.45	$1,269,382.27

To these costs are to be added a small amount, relatively insignificant, for the highly important items of traffic striping and directional signs, which will bring the total to slightly more than $1,270,000 for 10.71 miles, or $118,600 per mile.

A young lady who had never seen a game of baseball attended one with her escort.

"Isn't that pitcher grand?" she said. "He hits their bats no matter how they hold them!"

LAST DESERT LINK OF U. S. 91 IN CALIFORNIA UNDER CONSTRUCTION

By E. Q. SULLIVAN
District Engineer

WORK is under way on the last link of U. S. Highway No. 91 to be constructed by the Division of Highways between Los Angeles and the Nevada state line.

This route, leading to the city of Las Vegas in Nevada, has carried a heavy burden of traffic during and since the erection of the Boulder Dam.

The section under construction extends over rough desert country between Mountain Pass and the Nevada line, a distance of 15.4 miles and constitutes the largest and longest contract let in District VIII during the present biennium. The George Pollock Company are the contractors and the cost will approximate $285,203.

It is a region subject to sudden and extreme weather disturbances both summer and winter. Mountain Pass is a picturesque desert pass guarded on the north by rugged Clark Mountain that rises to an altitude of 7903 feet.

SUMMER CLOUDBURSTS FREQUENT

In the summer, hardly a week passes without spectacular thunder storms striking against the sides of the mountain with cloudbursts as the frequent results of such storms.

In winter it is the one spot between southern California and Nevada where heavy desert snowstorms are almost certain to occur, making it necessary to have a snow plow stationed at Mountain Pass to keep the road open.

After a snowstorm the temperature drops so low that surface ice forms and the maintenance crew is obliged to keep equipment on hand to "sand" the road so that traffic can proceed with safety.

The present contract work starts at Mountain Pass at an elevation of 4700 feet. The old road winds down the eastern slope with many sharp turns to the desert floor where it meanders around the edge of Ivanpah Dry Lake, dipping abruptly into washes and climbing over hummocks.

In summer cloudbursts interrupt the heavy traffic from Los Angeles to Boulder Dam by piling sand and gravel across this section of the old road where it dips into the washes. Snow and ice have made it equally difficult to keep the road safe for traffic in winter.

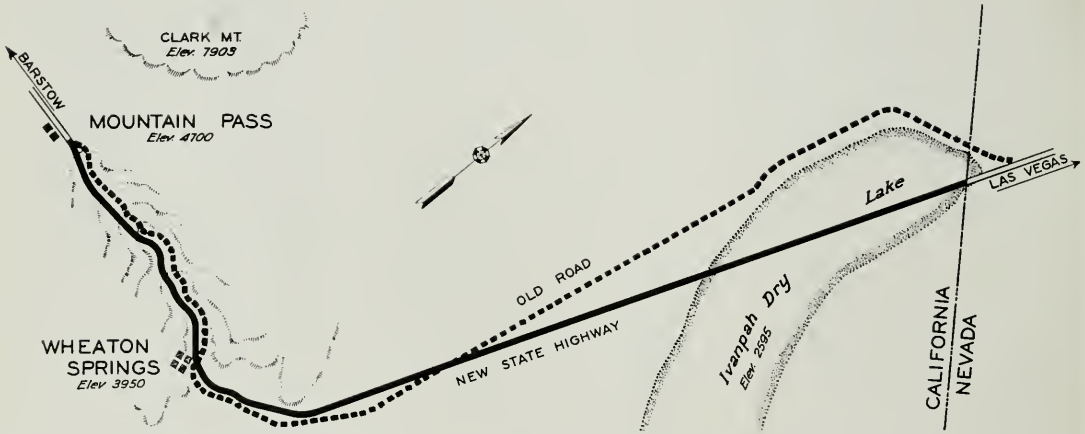
Ivanpah Dry Lake is a very large expanse of perfectly flat, hard-baked mud in dry weather, tempting the motorist to speed straight across it instead of following the road around its borders. Winter storms transform it into a small inland sea, the shallow muddy waters often obliterating the road and compelling wide detours.

The new road will follow a high standard of alignment eliminating sharp turns on Mountain Pass, spanning the washes on bridges and proceeding straight across Ivanpah Dry Lake on an embankment four miles long.

This roadway embankment will be covered with coarse, rocky material taken from a deposit on the north shore of the lake to make a good, substantial foundation for the oil-treated pavement.

Culverts will be placed under the roadway at 1000-foot intervals to allow the water to cross from one side of the lake to the other. This precaution is necessary because storms often break on one side of this queer lake, causing floods to pour into and across it, when the opposite side has received no rain. Were culverts not provided the embankment would act as a dam and the lake would rise behind the roadway and finally overflow it.

The contractors are pushing the work on this dry lake section at top speed and expect to complete the road across it before the winter storms begin.



"You mean to say you work 16 hours a day. I wouldn't think of doing that."

"I wouldn't either; it was the boss' idea."



The existing road on the Mountain Pass grade of U. S. 91 occasionally flooded by cloudburst waters is being relocated under contract now under way.



Ivanpah Dry Lake, appearing as white expanse extending nearly to foot of mountain, will be crossed by new road on an embankment four miles long.

21,000 RECKLESS DRIVERS PENALIZED BY JUDGES

Reckless, malicious, and careless drivers of motor vehicles during the month of August in California did not succeed so well in evading legal consequences, for over 21,000 of them were called before judges in all counties except Alpine and Colusa, and received penalties in fines and jail sentences as a result of the vigilance of motor vehicle officers.

CALWA OVERPASS NEAR FRESNO OPENED WITH OFFICIAL CEREMONIES

DEDICATION of the Calwa Overpass on U. S. 99, the Golden State Highway, four miles south of Fresno, on Monday, October 5, signalized the elimination of one of the most dangerous highway grade crossings in California.

The overpass carries the highway over North Avenue and across The Atchison, Topeka and Santa Fe main line where high board fences and buildings shut off the view of approaching trains. Twelve trains daily pass this point during normal train movements, but during the fruit season in September and October as many as seventy to eighty trains a day run over the crossing or switch back and forth across it.

Traffic counts taken by the Division of Highways revealed that more than 8000 motor vehicles daily used the old crossing. At times cars were backed up as much as a mile on either side of the intersection as a result of train blockades.

OFFICIALS WHO PARTICIPATED

The ceremonies attending the formal opening of the overpass were sponsored by the Fresno County Chamber of Commerce and participated in by Federal, State, county and city officials and representatives of neighboring communities. Governor Frank F. Merriam and Director of Public Works Earl Lee Kelly were represented by Edward J. Neron, Deputy Director of the Department of Public Works. Harry A. Hopkins, chairman of the California Highway Commission, officiated at the cutting of the ribbon which formally opened the overpass.

The Division of Highways was represented by R. M. Gillis, District Engineer, Fresno, and Earl Cummings, District Director of the WPA, took part in the dedication for the Federal government, which cooperated in the project.

Mayors of three cities, Z. S. Leymel of Fresno, G. Paul Vincent of Selma, and A. L. Lindquist of Kingsburg, together with P. H. McMurtry, chairman of the Fresno Board of Supervisors, and David E. Peckinpah, president of the Fresno Chamber of Commerce, participated in the program.

Two little girls from the Calwa Kindergarten, Eleanor Olson and Dorothy Wilson, proudly cut the ribbon stretching across the highway and Calwa Overpass was officially opened to the public.

A double line of automobiles from Fresno moved south over the bridge and another double line from Fowler, Selma and Kingsburg moved north, while the Fresno State College Band played.

Harry A. Hopkins, the principal speaker, told of the nation-wide grade separation program and praised the Federal government for making it possible. Other speakers cited the value of the improvement and the importance of railroad grade separations in the highway safety program.

"If one life is saved by the erection of this bridge, the cost will have been justified," said Frank G. Everts, chairman of the roads committee of the Fresno County Chamber of Commerce, who was master of ceremonies.

Following the dedication, R. R. Bishop of Long Beach, the general contractor on this project, and his superintendent, R. B. Wood, were hosts at a dinner attended by 75 participants in the celebration.

PLANNED IN 1929

Preliminary surveys for the overpass were made in May, 1929, but lack of funds prevented actual construction work until 1935 when California's allotment from the Works Program grade crossing fund became available. Bids were called for on December 4, 1935, and the contract was awarded in January, 1936.

The overpass is 2000 feet long, including the approaches. The reinforced concrete structure is 1740 feet in length with a roadway 44 feet wide, providing ample space for four lanes of traffic, and has a cantilever sidewalk on each side. With approaches made on 5 per cent grades with connecting vertical curves, motorists are assured a sight distance of 600 feet.

Twenty-eight 40-foot reinforced concrete girder spans, five skewed spans adjacent to the railroad span, and one central skewed steel span over the railroad comprise the superstructure.

The completed project cost approximately $210,000, largely financed with Federal funds.

'State's Highway Construction on Most Modern Basis'

Examples of this State's highway policy of straightening, relocating, and grade reducing are legion. All these put the road as nearly as can now be foreseen on its permanent location—the place where it will stay until the characteristics of motor transportation change materially.

Also, they all evince the most modern ideas of construction. In fact, all highway construction throughout the State system is on a highly modern basis. The engineers consider the amount and quality of traffic which will use the road, the foundation materials available, difficulties of producing a proper grade and other conditions, and then decide on the type and weight of construction, the exact routing and other phases of the project which will be most economical in the long run. This requires nice balancing between the cost of construction and the cost of operating the vehicles which will use the route, but the constant effort is to build the road that will cost the least to construct, maintain and use.

Motor Land.

"Is this the laundry? Well, you sent me a half a dozen very old handkerchiefs instead of my shirt."

"Them ain't handkerchiefs. That is your shirt."



Calwa Overpass on U. S. 99 near Fresno officially opened October 6 has a roadway width of 44 feet between sidewalk curbs providing space for four lanes of traffic crossing the main line of Atchson, Topeka and Santa Fe railroad where peak traffic count is 70 to 80 trains and 8000 automobiles daily.

Another view of the overpass structure showing surfaced detour that accommodated a large volume of heavy and light traffic avoiding any interruption of construction activities while the project was under way.

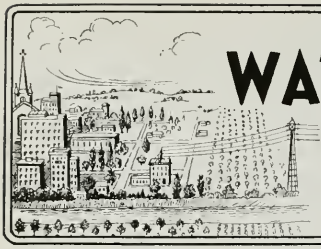




The reinforced concrete structure is 1740 feet in length with a cantilever sidewalk on each side of the roadway. The total length of this overhead grade separation including the approaches is 2000 feet.



The official group, left to right: P. H. McMurtry, chairman Fresno Supervisors; Z. S. Leymel, Mayor; R. B. Wood, Bishop Co. superintendent; Deputy Director of Public Works Ed Neron; President Peckinpah, Fresno Chamber of Commerce; Mayor Lindquist, Kingsburg; Norman Asp; Mayor Vincent, Selma; Chairman Hopkins, Highway Commission; F. G. Everts, Fresno; Resident Engineer M. E. Whitney; W. P. Jennings; George Hamm; Contractor R. R. Bishop; Dorothy Wilson and Eleanor Olsen.



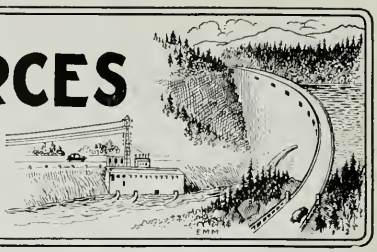
DIVISION OF WATER RESOURCES

OFFICIAL REPORT

FOR THE MONTH OF

September, 1936

EDWARD HYATT, State Engineer



Preparations for snow survey work during the coming winter have been made during the past month. Three new survey courses have been laid out on the slopes of the most westerly divide of the Sierra mountain range in Tulare County with the assistance of rangers of the Sequoia National Forest.

News of the irrigation districts, flood control and reclamation work, dam applications and approvals, topographic mapping and other activities of the Division of Water Resources during the past month will be found in the following report of the State Engineer:

IRRIGATION DISTRICTS

Among the matters referred to the State Engineer during the past month for investigation and report were several petitions filed with the District Securities Commission for approval of expenditures in connection with construction or repair of irrigation systems.

The plans of West Side Irrigation District to improve the drainage conditions were inspected. The work contemplates expenditure of about $3,500 for a booster pump and excavation of 22,000 cubic yards in lateral drains.

A project of Fairoaks District for replacing a section of its old supply line with 3000 feet of 30-inch steel, soil proofed pipe was investigated. The proposed work will be carried out with the assistance of WPA labor.

Petition of Grenada Irrigation District for approval of expenditure of $1,800 on its main pipe line, was the subject of a report. The district plans to replace 750 feet of 48-inch wood stave pipe which has deteriorated with age.

Fallbrook Irrigation District requested an investigation regarding feasibility of $500,000 bond issue for construction of irrigation works and purchase of water bearing lands.

Citrus Heights Irrigation District has applied to the RFC for loan of $91,200 to refinance outstanding indebtedness of $152,000.

El Camino Irrigation District has accepted a refinancing plan to be carried out with private funds. This is the only district that has recently attempted readjustment of financial difficulties without seeking federal aid.

FLOOD CONTROL AND RECLAMATION

Maintenance of Sacramento Flood Control Project

Routine maintenance work has been carried on by a small regular crew. In the repair of the Davis bridge in the Sutter Bypass, five new trestle bents have been driven, using creosoted piles and timber. It is expected that the three new drainage pumping plants, costing approximately $250,000, constructed by the California Debris Commission, will be fully completed and turned over for operation by October 15th.

Relief Labor Work

Clearing of the Feather River channel above Marysville has continued with a relief labor crew of about 30 men. It is expected that the relief labor available will show a rapid increase during the Fall months.

Bank Protection Program

Preparations are being rushed to commence work on maintenance bank protection program by the State and the United States under agreement of June, 1932. Surveys and preparation of plans are progressing rapidly, and it is expected that actual construction will be commenced within ten days.

Sacramento Flood Control Project

Work on incidental construction on levee rights of way has continued employing approximately 30 men. New work to be undertaken shortly consists of the construction of fences, the pumping plant on Keller ranch on the west side of Sacramento River above Colusa, and a concrete retaining wall on the Sartain and Terrill Ranch on the east side.

Flood Measurements and Gages

Actual operation of the flood gages maintained by this Division will commence November 1st. Preliminary work is under way preparing and putting stations in good condition and improving certain installations. This division is installing a new automatic recorder station at junction of Sacramento and Yolo By-passes. The War Department is preparing to install similar gages on Sacramento River at Ord's Ferry and at Sacramento Weir, and on the Feather River at Shanghai Bend.

SUPERVISION OF DAMS

Application for approval of plans and specifications for the Crater Lake Dam in Alpine County was filed on August 26, 1936. The dam is to be an earth fill 30 feet in height and storing 320 acre-feet of water for irrigation.

Application was filed September 12, 1936, for approval of plans and specifications for the Mowich Dam in Modoc County. The dam is to be an earth fill 11 feet in height storing 175 acre-feet of water for irrigation.

Application for approval of plans for alteration of the Thomas Briles Dam in Modoc County was filed August 20, 1936. The work consists of construction of an adequate spillway.

Application for approval of plans for repair of the Rye Grass Swale Dam in Modoc County was filed August 20, 1936. The work consists of widening the dam, enlarging the spillway and increasing the height to provide adequate wasting capacity and freeboard. This application was approved on September 2, 1936.

Application was filed August 21, 1936, for approval of plans for repair of the Green Valley Lake Dam in San Bernardino County. This application was approved September 1, 1936.

Application was filed September 15, 1936, for approval of plans for alterations to the Lake Spaulding Dam, consisting of buttress repairs on the small auxiliary dam.

Application for the approval of plans and specifications for construction of Putah Creek Dam of the city of Winters in Yolo County was approved August 28, 1936.

Application for the approval of plans and specifications for alteration of Pine Creek Dam in Modoc County was approved August 22, 1936.

Work which was discontinued during the spring and summer on Coyote Dam of the Santa Clara Valley Water Conservation District has been resumed. The work remaining to be done consists principally of concreting the spillway channel and placing rockfill on the two faces of the dam.

Excavation work at the site of Mad River Dam for the city of Eureka is nearing completion.

Construction of the West Valley Dam of South Fork Irrigation District in Modoc County has been completed.

Pouring of concrete on the enlargement of O'Shaughnessy Dam of the city of San Francisco in Yosemite National Park is progressing.

Work is under way at both Grant Lake and Long Valley dams of the city of Los Angeles.

Work is progressing satisfactorily at Cajalco Dam of the Metropolitan Water District.

Work of the Los Angeles County Flood Control District at San Gabriel Dam Num-

ber One and at Eaton Wash is proceeding satisfactorily.

Construction of Sheffield Dam of the city of Santa Barbara is practically completed and work is well along on Mono Dam.

Repairs to Lake Hodges Dam of the city of San Diego are approximately 50 per cent complete.

Construction of Judson Reservoir Dam in San Diego County is proceeding satisfactorily.

The usual inspections for maintenance and operation are being made in addition to those necessary on the construction and repair work.

WATER RIGHTS

Supervision of Appropriation of Water

Thirty-two applications to appropriate water were received during August, 12 were denied and 19 approved. Six permits were revoked during the month and rights under 5 permits were confirmed by issuance of license.

Since our last report projects have been inspected preliminary to the issuance of license, or orders revoking the permits, in Calaveras, Amador, Alpine, El Dorado, Placer, Nevada, Yuba, Butte, Sutter, Colusa, Yolo and Sacramento counties, which concludes the field work for this season.

Water Distribution

Water master service in the following districts was continued throughout the month: Owl, Soldier, Emerson, Cedar, Deep and Mill Creek water master districts (in Surprise Valley, Modoc County) New Pine, Davis and Franklin Creek water master districts (in Goose Lake Valley, Modoc County); South Fork of Pit River, Pine Creek, Hot Springs Valley and Big Valley water master districts (in Modoc and Lassen counties); Shasta River Water Master District (in Siskiyou County); Hat, Burney and Cow Creek water master districts (in Shasta County).

SACRAMENTO - SAN JOAQUIN WATER SUPERVISION

During the past month, the activities of this office have been that of carrying on the routine detail so that a report may be made at the end of the irrigation season which will show the amount of water diverted from and returned to streams in the Sacramento-San Joaquin territory. It will also show the amount of land irrigated; the flow in stream channels and the rate of advance and retreat of salinity in the Delta.

The stream flow has passed the minimum stage and is now showing a marked increase. Two factors contribnte to this—lessened pumping and rice field drainage. Most of the rice is now being drained and in some areas harvesting has actively begun. Orchard and beans are the main crops being irrigated at present.

The salinity at the Delta stations has remained about constant during the month.

CALIFORNIA COOPERATIVE SNOW SURVEYS

During the past month, partial arrangements have been made for the snow survey work to be done next winter. All agencies in the southern end of the San Joaquin Valley have been contacted, inventories checked over, and missing items of equipment replaced.

Three new snow survey courses were laid out on the slopes of the most westerly divide of the Sierra in Tulare County. One of these, on the headwaters of Deer Creek, is located at Dead Horse Meadow, above California Hot Springs and the other two on the headwaters of Tule River are at Quaking Aspen and the Old Enterprise Mill site, respectively, the former being above Camp Nelson, and the latter in the vicimty of Balch Park.

Rangers of the Sequoia National Forest assisted in the laying out of these courses and arrangements have been made for the men of the Forest Service to conduct the necessary winter surveys at these locations, as well as at several other stations soon to be established in the mountains farther north.

TOPOGRAPHIC MAPPING

Progress was made during August on field work in connection with the Tobias Peak Quadrangle in Tulare and Kern counties and the Downieville No. 1 Quadrangle in Plumas and Sierra counties under the general cooperative mapping program.

Advance sheets of Acton, Boneyard Canyon, Camp Baldy, Camp Bonita, Camp Rincon, Cima Mesa, La Verne and Evy Canyon, Mescal Creek and Valyermo Quadrangles in Los Angeles County are now available. This work was done by the United States Geological Survey in cooperation with the county of Los Angeles.

WATER RESOURCES

South Coastal Basin Investigation

Good progress has been made in the field and office on the South Coastal Basin Investigation during the past month.

Water supplies of four proposed prison sites in southern California have been investigated and reported upon.

San Luis Rey River—San Diego County

The investigation and survey of San Luis Rey River in San Diego County for the purpose of securing data and preparing plans for flood control, rectification of river channels and conservation and utilization of the waters of the San Luis Rey made by the Division of Water Resources in cooperation with WPA, city of Oceanside, county of San Diego and Carlsbad Mutual Water Company have been completed and a report on the results of the survey is now in course of preparation.

Central Valley Project

The United States Bureau of Reclamation is exerting every effort to complete at an early date the preparation of plans necessary for starting construction on the initial units of the project. Preliminary investigations and exploration work have been carried on during the month at Kennett and Friant dam sites and surveys continued along the Contra Costa Conduit and Friant-Kern Canal by the bureau. Appraisers are in the field evaluating lands and necessary rights of way to be acquired. The Division of Water Resources is conducting surveys and making investigations in the San Joaquin Valley preliminary to the acquisition of properties and water rights necessary for the construction of the project.

Friant Dam Lake Will Be 6 Miles Long By 2 Wide

(Continued from page 17)

age capacity of 450,000 acre-feet and will flood an area of 4510 acres, having a length of six miles and a maximum width of about two miles.

Following the meeting with the Water Project Authority, Mr. Page and a large number of guests were entertained at a dinner at the Sutter Club given in honor of the acting commissioner by the Sacramento Chamber of Commerce.

On Wednesday, September 23, Mr. Page, accompanied by Mr. Young, the State Engineer, and members of his staff, drove by automobile to Contra Costa County for an inspection of the Contra Costa County conduit and the district to be served therefrom. Lunch was served at Los Medanos Hotel, Pittsburg, attended by local representatives. The party then drove to Fresno by the West Side Highway, inspecting irrigation developments and the proposed San Joaquin pumping system of the project, arriving for dinner at the Fresno Hotel that evening.

Thursday morning, September 24, the party inspected Friant Dam and Friant-Kern Canal of the Friant Division of the project, and also Pine Flat Reservoir. The Fresno Chamber of Commerce arranged a luncheon at the Californian Hotel, after which the party proceeded to Navelencia, Orange Cove, and thence to Lindsay for dinner and a night meeting with local representatives at the Mount Whitney Hotel.

Friday morning, September 25, the acting commissioner and his party boarded a train en route for Los Angeles.

MILITARY ROAD MILEAGE 69,823

Highways classified by the War Department as "military priority roads" have reached a total of 69,823 miles. An official map issued by the department gives first priority designation to 23,429 miles of highway rated of prime importance from the viewpoint of national defense. Second priority roads total 32,230 miles, and third priority roads 14,164 miles.

Highway Bids and Awards for September, 1936

COLUSA COUNTY—Between 5.4 miles west of Williams and Williams, about 5.4 miles to be widened, surfaced with gravel and seal coat applied. District III, Route 15, Section E. Clausen-Embleton Co., Albany, $34,460; J. A. Casson, Hayward, $32,455; Union Paving Co., San Francisco, $43,524; Fredericksen & Westbrook, Lower Lake, $34,555. Contract awarded to Hanrahan Co., San Francisco, $29,939.

FRESNO COUNTY—Between Biola Junction and Herndon, 3.9 miles to be graded and paved with asphalt concrete and Portland cement concrete. District VI, Route 4, Section C. United Concrete Pipe Corp., Los Angeles, $215,034. Hanrahan Co., San Francisco, $204,898. Griffith Co., Los Angeles, $237,233. Contract awarded to Union Paving Co., San Francisco, $196,576.

FRESNO COUNTY—Bridge across Lone Tree Channel, 13.8 miles east of Fresno. District VI, Route 41, Section S. Mid State Const. Co., Fresno, $6,435. Contract awarded to R. R. Bishop, Long Beach, $6,085.

FRESNO COUNTY—Between south city limits of Fresno and Floral Avenue. About 9.8 miles crusher run base borders to be constructed, nonskid surface treatment to existing pavement and portion of borders and road-mix surface treatment to shoulders. District VI, Route 125, Section B. Hanrahan Company, San Francisco, $52,512. Contract awarded to L. A. Brisco, Arroyo Grande, $46,988.40.

GLENN COUNTY—Between Artois and Orland, about 7.4 miles graded and paved with asphalt concrete. District III. Route 7, Sections B, C. J. A. Casson, Hayward, $199,-813; David H. Ryan, San Diego, $191,858. Contract awarded to Union Paving Co., San Francisco, $186,585.

HUMBOLDT COUNTY—Repairs to existing bridge across South Fork Trinity River one mile west of Salyer. District I. Route 20, Section D. E. S. Mackins, Eureka, $2,934. Contract awarded to Mercer-Fraser Co., Eureka, $2,745.

IMPERIAL COUNTY—Liquid asphalt furnished and applied to shoulders and roadsides, 32 miles, between Trifolium Canal and Imperial-Riverside county line. District XI, Route 26, Section B C D E. Morgan Bros., $13,182; Oilfields Trucking Co., $16,192; Paulsen & March, $15,756; Gilmore Oil Co., $15,163. Contract awarded to Square Oil Company, Los Angeles, $13,026.

IMPERIAL COUNTY—7.6 miles gravel surfacing and liquid asphalt furnished and applied, one mile east of Heber and three miles east of Imperial. District XI, Route 201, Section A, B. V. R. Dennis Constr. Co., $20,959. Contract awarded to R. E. Hazard & Sons, San Diego, $14,865.

INYO COUNTY—Between 2 miles east of Lone Pine and 1 mile east of Owens River, about 1.7 miles grading and road mix surfacing and timber bridge. District IX, Route 127, Section C. A. S. Vinnell Co., Los Angeles, $24,980; Young & Son Co., Ltd., Berkeley, $32,475. Contract awarded to Basich Bros., Torrance, $23,314.80.

INYO COUNTY—Between 1.2 miles north of Lone Pine and Big Pine. Portions, 18.6 miles surfaced with plant-mix and penetration oil treatment of shoulders. District IX, Route 23, Sections L, M, A, B, C. A. S. Vinnell Co., Los Angeles, $72,686; C. O. Sparks & Mundo Eng. Co., Los Angeles, $72,686. Contract awarded to Oswald Bros., Los Angeles, $64,896.20.

INYO COUNTY—Place imported borrow and apply road-mix treatment and seal coat to about 0.9 mile, Little Lake to Cartago. District IX, Route 23, Sections G, J. Contract awarded to A. S. Vinnell Co., Los Angeles, $10,225.

INYO COUNTY—Between 2.5 miles and 0.7 mile south of Inyo-Mono county line, 1.7 miles graded and road-mix surface treatment and seal coat applied. District IX, Route 23, Section F. A. S. Vinnell Co., Los Angeles, $22,529. Contract awarded to Basich Bros., Torrance, $29,216.70.

INYO COUNTY—Between 4 miles and 1.7 miles S. of Fist Springs, about 2.3 miles to be graded, surfaced with salvaged surfacing and road-mix surface treatment applied. District IX, Route 23, Section B. Oswald Bros., Los Angeles, $49,323. Contract awarded to Basich Bros., Torrance, $43,555.

KERN COUNTY—Between Bakersfield and Mt. View school, about 9 miles, construct crusher run base borders, surface roadbed with plant-mix and apply road-mix surface treatment to the shoulders. District VI, Route 58, Sections C, A. J. A. Casson, Hayward, $89,225; Oswald Bros., Los Angeles, $90,999; Hanrahan Co., San Francisco, $98,-701; A. S. Vinnell Co., Los Angeles, $84,962; Union Paving Co., San Francisco, $86,163. Contract awarded to Griffith Co., Los Angeles, $84,420.80.

KERN COUNTY—Between Grove Street in Bakersfield and 11.7 miles south, grading and paving with asphalt concrete. District VI, Route 4, Section C & Bkd. Southern California Roads Co., Los Angeles, $310,436; V. R. Dennis Const. Co., San Diego, $289,-270; Union Paving Co., San Francisco, $284,-339; David H. Ryan, San Diego, $282,055; Gogo & Rados, Los Angeles, $265,600; Basich Bros., Torrance, $305,585; United Conc. Pipe Corp., Los Angeles, $251,152. Contract awarded to Griffith Co., Los Angeles, $245,578.20.

KINGS COUNTY—Between Route 10 and Hub, about 6 miles crusher run base borders to be constructed, plant mixed surfacing and road mixed surface on shoulders. District VI, Route 125, Section E. Hanrahan Company, San Francisco, $38,455. Contract awarded to Leo F. Piazza, San Jose, $36,-471.50.

KINGS COUNTY—Timber bridge east branch Cross Creek, two miles east of Corcoran. District VI, Route 135, Section B. R. Hodgreson & Sons, Porterville, $7,022; Wm. C. Horn Co., Pomona, $8,353; Peter J. McHugh, Sacramento, $8,735; Mid State Const. Co., Fresno, $7,285. Contract awarded to F. O. Bohnett Co., Campbell, Calif., $7,010.

LASSEN COUNTY—Between Termo and Madeline, 14.2 miles to be graded. District II, Route 73, Section F. Fredericksen & Westbrook, Lower Lake, $32,032; Louis Biasotti & Son and Claude C. Wood, Stockton, $36,895; Dunn & Baker, Klamath Falls, Ore., $38,324; Harms Bros., Doyle, $38,995; Hemstreet & Bell, Marysville, $41,703; Daniel Bayles, Biggs, $41,929; Dodge Construction, Inc., Fallon, Nev., $48,488; Isbell Construction Co., Reno, Nevada, $55,917; Union Paving Co., San Francisco, $84,809. Contract awarded to Poulson & McEwen, Sacramento, $30,247.80.

LOS ANGELES COUNTY—Sepulveda Boulevard from Lincoln Boulevard (Rte. 60) to Centinela Avenue (Rte. 164), about 3.1 miles graded and paved with Portland cement concrete. District VII, Route 158, Section L.A., B. Basich Bros., Los Angeles, $258,151; Griffith Co., Los Angeles, $225,761; J. E. Haddock Co., Ltd., Pasadena, $254,-545; United Conc. Pipe Co., Los Angeles, $234,377; Oswald Bros., Los Angeles, $236,-510. Contract awarded to Matich Bros., Elsinore, $218,501.80.

LOS ANGELES COUNTY—A reinforced concrete girder bridge across Los Angeles River at Atlantic Avenue, about 7 miles north of Long Beach, consisting of thirteen 64-ft. spans and two 18-ft. cantilever spans on concrete piers with pile foundations. District VII, Route 167, Section A. C. W. Caletti & Co., San Rafael, $215,202; R. R. Bishop, Long Beach $189,960; Sharp & Fellows Contg. Co., Los Angeles, $186,417; Shofner & Gordon, Los Angeles, $237,051; Byerts & Dunn, Los Angeles, $190,900; John Strona, Pomona, $174,784; Carlo Bongiovanni Const. Co., Los Angeles, $188,695. Contract awarded to J. F. Knapp, Oakland, $159,968.

LOS ANGELES COUNTY—Between Azusa and Claremont, about 8 miles graded and paved with asphalt concrete. District VII, Route 9, Section LA 9-H-I-J-LVn-C, Cla. W. E. Hall Co., Alhambra, $114,858; George Herz Co., San Bernardino, $116,464; Griffith Co., Los Angeles, $113,351; United Concrete Pipe Corp., Los Angeles, $125,248; Oswald Bros., Los Angeles, $116,427. Contract awarded to Geo. R. Curtis Paving Co., Los Angeles, $107,283.35.

LOS ANGELES COUNTY—Between Polyhi Court and Stanley Avenue, 1.2 miles graded and paved with asphalt. District VII, Route 60, Section L. Bch. Sig.H. Griffith Co., Los Angeles, $145,012; United Concrete Pipe Corp., Los Angeles, $146,211; Oswald Bros., Los Angeles, $133,462. Contract awarded to Sully-Miller Cont. Co., Long Beach, $129,722.50.

LOS ANGELES COUNTY—Between Brea and Pomona, about 6.5 miles pavement borders of plant-mixed surfacing to be constructed. District VII, Route 19, Section B. Southwest Pave. Co., Roscoe, $16,887; Geo. R. Curtis Pave. Co., Los Angeles, $23,608; Griffith Co., Los Angeles, $21,145; Oswald Bros., Los Angeles, $18,421. Contract awarded to Sander Pearson, Santa Monica, $15,501.20.

LOS ANGELES COUNTY—Washington Boulevard, between Spence Street and Downey Road, about 0.3 mile graded and paved with Portland cement concrete, asphalt concrete and bituminous macadam armor coat on selected material base. District VII, Route Feeder Road. Griffith Company, Los Angeles, $77,226; C. O. Sparks & Mundo Engineering Co., Los Angeles, $76,267; Southern California Roads Co., Los Angeles, $78,887; R. E. Campbell, Los Angeles, $76,-218. Contract awarded to C. F. Robbins, Los Angeles, $71,434.05.

LOS ANGELES COUNTY—Between Monterey Park and Pomona, 18.7 miles Portland cement concrete pavement widening to be placed. District VII, Route 26, Sections A, E. Mte, B, W Cov & C. Gogo and Rados, Los Angeles, $274,750; David H. Ryan, San Diego, $261,021; United Concrete Pipe Corp., Los Angeles, $294,639; Oswald Bros., Los Angeles, $267,670; J. E. Haddock, Ltd., Pasadena, $288,422; Basich Bros., Torrance, $283,-576. Contract awarded to Griffith Co., Los Angeles, $249,803.

LOS ANGELES COUNTY—Between Route 19 and Anaheim-Spadra Road, 0.5 mile graded and paved with Portland cement concrete. District VII, Route 172, Section C. Griffith Co., Los Angeles, $32,045; Dimmitt

& Taylor, Los Angeles, $28,865; Sander Pearson, Santa Monica, $28,650. Contract awarded to C. R. Butterfield, San Pedro, $21,951.50.

LOS ANGELES COUNTY—A reinforced concrete girder bridge across San Gahriel River 3 miles north of Santa Fe Springs, consisting of six 63' spans and two 22' cantilevers and 0.39 mile of approach to be graded and paved with Portland cement concrete and plant-mixed surfacing. District VII, Route 166, Section A. T. A. Allen Const. Co., Los Angeles, $112,475. J. F. Knapp, Oakland, $119,882. D. W. Thurston, Los Angeles, $156,394. J. E. Haddock, Ltd., Pasadena, $117,325. Contract awarded to John Strona, Pomona, $108,890.75.

LOS ANGELES COUNTY—Firestone Boulevard through Downey, about 0.9 mile existing roadbed to be widened and widening strips of P. C. C. and plant-mixed surfacing to be placed. District VII, Route 174, Section B. Gogo & Rados, Los Angeles, $83,491; Griffith Co., Los Angeles, $80,869; Geo. R. Curtis Paving Co., Los Angeles, $87,661; United Concrete Pipe Corp., Los Angeles, $98,152; Oswald Bros., Los Angeles, $83,173. Contract awarded to Sander Pearson, Santa Monica, $69,950.75.

MADERA COUNTY—Between 0.6 miles and 7.9 miles north of Madera, about 7.3 miles constructing borders of plant-mix surfacing and applying road-mix surface treatment to shoulders. District VI, Route 4, Section B. Leo F. Piazza, San Jose, $32,-461; Union Paving Co., San Francisco, $37,210. Contract awarded to Hanrahan Co., San Francisco, $31,385.

MERCED COUNTY—Between Los Banos and 10.5 miles E., 10.5 miles to be graded with crusher run base and surfaced with plant mix. District X, Route 32, Section C. Union Paving Co., San Francisco, $226,722. United Concrete Pipe Corp., Los Angeles, $249,759. Contract awarded to Louis Biasotti & Son and Claude C. Wood, Stockton, $222,-557.50.

MONO COUNTY—Between Convict Creek and Antelope Valley, about 46.7 miles, apply seal coat. District IX, Route 23, Sections D, E, F, G, H, and K. Oilfields Trucking Co., Bakersfield, $27,606. Contract awarded to A. S. Vinnell Co., Los Angeles, $25,773.15.

MONO COUNTY—Between Bridgeport and 2.4 miles northerly, 2.4 miles to be graded. District IX, Route 96, Section A. Isbell Construction Co., Reno, Nevada, $13,-833; Basich Brothers, Torrance, $14,040. Contract awarded to C. A. Baker, North Sacramento, $8,358.40.

MONTEREY COUNTY — Between San Ardo and King City, about 5.8 miles retread surfacing on portions and seal coat applied to portions. District V, Route 2, Sections G, F. L. A. Brisco, Arroyo Grande, $20,329. Contract awarded to Granite Construction Co., Watsonville, $18,646.

MONTEREY COUNTY — Between Big Creek and Anderson Canyon, about 7.1 miles, penetration oil treatment to existing roadbed. District V, Route 56, Section D. A. E. Garcia, Jr., Irvington, $7,158; L. A. Brisco, Arroyo Grande, $5,071; Treslau Bros., Berkeley, $7,417. Contract awarded to Oilfields Trucking Co., Bakersfield, $4,881.75.

MONTEREY COUNTY—Between Gonzales and Chualar and between Hilltown and Monterey, about 20.1 miles, shoulders treated with liquid asphalt. District V, Route 2, 117, Section C. A. Oilfields Trucking Co., Bakersfield, $11,064; L. A. Brisco, Arroyo Grande, $10,779; Granite Constr. Co., Ltd., Watsonville, $11,724; A. E. Garcia, Jr., Irvington, $11,519. Contract awarded to Albert J. Raisch, San Jose, $10,566.

NAPA COUNTY—Maintenance station buildings and appurtenances. District IV, Route 49, Section B. John E. Branagh, Piedmont, $12,489; Empire Construction Co., Ltd., San Francisco, $11,777; Central California Construction Co., Inc., San Francisco, $12,748; Fred J. Early, Jr., San Francisco, $14,067. Contract awarded to C. G. Langum, Napa, $10,889.

ORANGE COUNTY—Reinforced concrete bridge across Santa Ana River, on Bolsa Avenue, 2.3 miles west of Santa Ana, consisting of seven 57' girder spans and two 19' end spans on concrete piers and approximately 20 miles of grading and plant-mixed surfacing. Griffith Co., Los Angeles, $67,161; Carlo Bongiovanni Const. Co., Los Angeles, $69,700. Contract awarded to J. F. Knapp, Oakland, $62,235.50.

ORANGE COUNTY—On Ocean Ave. at Santa Ana River, 0.5 miles, a reinforced concrete girder bridge, thirteen 44' 6" spans and two 16' end cantilevers on concrete bents to be constructed and approaches to be graded and surfaced with plant mix. District VII, Route 179, Section A. Griffith Co., Los Angeles, $76,818. Bates and Rogers Const. Co., San Francisco, $78,812. Byerts and Dunn, Los Angeles, $71,841. R. R. Bishop, Long Beach, $74,950. Donald Atkinson, San Francisco, $72,242. Contract awarded to J. F. Knapp, Oakland, $66,575.

ORANGE COUNTY—Between Newport Beach and Laguna Beach, about 8.9 miles graded and paved with Portland cement concrete. District VII, Route 60, Section Npt. B & B. Gogo and Rados, Los Angeles, $173,-270; Griffith Co., Los Angeles, $180,148; Oswald Bros., Los Angeles, $191,206. Contract awarded to Geo. R. Curtis Paving Co., Los Angeles, $172,176.40.

RIVERSIDE COUNTY—Between Edom and Riverside-Imperial County line. liquid asphalt furnished and applied to shoulders, about 32 miles. District XI, Route 26, Sections E, F, G. Paulsen & March, $6,736; Morgan Bros., $6,259; Gilmore Oil Co., $6,359. Contract awarded to Square Oil Co., Los Angeles, $5,747.50.

RIVERSIDE COUNTY—Desert Center to Blythe, liquid asphalt to be furnished and applied to 47.2 miles. District XI, Route 64, Section C, D. & E. Lamb Transfer Co., $16,-548; Paulsen & March, $15,330; Square Oil Co., $14,700; Morgan Bros., $14,980. Contract awarded to Regal Oil Co., Long Beach, $13,930.

SACRAMENTO COUNTY—Between H Street subway and Auburn Boulevard, 1.2 mile to be surfaced with bituminous treated surfacing (plant-mixed) and 4.1 miles to be surfaced with crusher run base. District III, Route 98, Section A. Heafey-Moore Co., Oakland, $61,445; A. Teichert & Son, Inc., Sacramento, $65,760; Geo. Pollock Company, Sacramento, $63,795. Contract awarded to J. A. Casson, Hayward, $59,065.

SACRAMENTO, PLACER, YUBA, SUTTER, BUTTE, YOLO, COLUSA, GLENN, EL DORADO and NEVADA COUNTIES—At various locations, about 425 miles of traffic striping. District III, various routes and sections. S. A. Cummings, San Diego, $2,762. Contract awarded to Al W. Simmonds, Sacramento, $2,470.

SAN BENITO, MONTEREY, SAN LUIS OBISPO, SAN BERNARDINO COUNTIES—Traffic stripe at various locations. District V, Route, various. Al. W. Simmonds, Sacramento, $4,296; D. I. Ansite, Inglewood, $4,604. Contract awarded to S. A. Cummings, San Diego, $3,874.50.

SAN BERNARDINO COUNTY — Steel stringer bridge with concrete deck across Chino drainage canal about 4 miles south of Pomona, to be constructed and 0.27 miles roadway graded and road mix surface treatment. District VII, Route 77, Section A. Dimmitt & Taylor, Los Angeles, $32,379; V. R. Dennis Const. Co., San Diego, $40,290; John Strona, Pomona, $36,644. Contract awarded to C. F. Robbins, Los Angeles, $32,269.25.

SAN BERNARDINO COUNTY—In San Bernardino County between Yermo and Baker, about 11.6 miles, asphaltic emulsion furnished and applied for 20 foot average width. District VIII, Route 31, Sections H and J. Square Oil Co., Los Angeles, $2,090; American Bitumuls Co., Los Angeles, $2,280; Lambs Transfer Co., Long Beach, $2,100; Paulsen & March, Inc., Los Angeles, $2,185. Contract awarded to Gilmore Oil Co., Los Angeles, $1,914.25.

SAN DIEGO-IMPERIAL COUNTIES—At various locations between 2 miles east of Alpine and 0.2 mile east of the San Diego-Imperial County line, about 8.4 miles; plant-mix surfacing of existing pavement, constructing shoulders and applying road-mix surface treatment. Daley Corp., San Diego, $72,569; V. R. Dennis Cons. Co., San Diego, $76,805. Contract awarded to R. E. Hazard & Co., San Diego, $67,812.

SAN DIEGO COUNTY—North city limits of San Diego to Linda Vista Road, liquid asphalt furnished, applied to shoulders, about 7.1 miles. District XI, Route 77, Section A. Morgan Bros., Huntington Beach, $2,824; Paulsen & March, Los Angeles, $2,532. Contract awarded to Regal Oil Company, Long Beach, $2,309.50.

SAN DIEGO COUNTY—On El Cajon Avenue in San Diego, from Texas Street to Euclid Avenue, 2.7 miles graded and paved with Portland cement concrete. V. R. Dennis Construction Co., San Diego, $299,973; Griffith Co., Los Angeles, $304,929; Basich Bros., Torrance, $285,390. Contract awarded to Daley Corporation, San Diego, $283,922.45.

SAN MATEO COUNTY—Between Menlo Country Club and Woodside, 1.3 miles to be graded with crusher run base and surfaced with bituminous macadam. District IV, Route 107, Section A. Hanrahan Co., San Francisco, $82,861. Piombo Brothers & Co., San Francisco, $68,959. Fredericksen and Westbrook, Lower Lake, $66,585. Contract awarded to Union Paving Co., San Francisco, $64,869.80.

SANTA BARBARA COUNTY—Between Puente Drive and Maria Ygnacio Creek, about 1.4 miles, removal and disposal of trees. District V, Route 2, Section K. The Gillum Co., Summerland, $6,165. Contract awarded to L. A. Brisco, Arroyo Grande, $4,940.

SANTA BARBARA COUNTY—Between Las Cruces and Lompoc and between Zaca and Painted Caves Road, about 43.8 miles, portions of existing pavement to be surfaced with plant mix and seal coat applied to exing pavement and new surfacing. District V, Route 56 and 80, Section A B and A B C. J. A. Casson, Hayward, $44,928. Contract awarded Heafey-Moore Co., Oakland, $44,-899.

SANTA CLARA COUNTY—Between Agnew Underpass and San Jose, about 3.0 miles to be graded and paved with Portland cement concrete. District IV, Route 68, Section B. Union Paving Co., San Francisco, $263,933; Fredericksen & Westbrook, Lower Lake, $267,808; Basich Bros., Torrance, $243,920; Hanrahan Co., San Francisco, $301,510. Contract awarded to A. J. Raisch & Earl W. Heple, San Jose, $225,112.45.

SANTA CLARA COUNTY—Between San Jose and Coyote, 10.4 miles, to be graded and paved with asphalt concrete. District IV, Route 2, Section B. David H. Ryan, San Diego, $307,364; A. Teichert & Son, Inc., Sacramento, $343,072.50; A. J. Raisch, San Jose, $318,247; Basich Brothers, Torrance, $299,433; Union Paving Co., San Francisco, $293,525; Hanrahan Company, San Francisco, $273,611. Contract awarded to Jones & King, Hayward, $253,494.

SANTA CLARA COUNTY—Between State Route 68 and the north city limits of San Jose, about 1.2 miles graded and road-mix surface treatment applied. District IV, Route Feeder Road. J. A. Casson, Hayward, $67,968; Fredericksen & Westbrook, Lower Lake, $73,374; Basich Brothers, Torrance, $62,657; Earl W. Heple, San Jose, $62,976; Hanrahan Co., San Francisco, $89,515; Union Paving Co., San Francisco, $71,442. Contract awarded to A. J. Raisch Co., San Jose, $42,808.

SANTA CLARA COUNTY—Five bridges across Guadalupe River and overflow channels about 3 miles north of San Jose, District IV, Route 68, Section B. A. J. Raisch Co., San Jose, $57,942; F. O. Bohnett Co., Campbell, $59,572; Earl W. Heple, San Jose, $58,548; Carl N. Swenson Co., San Jose, $59,042, Heafey-Moore Co.. Oakland, $60,362; Lindgren & Swinerton, Inc.. Oakland, $63,796; McManus & Chick, Berkeley, $64,393; Bundesen & Lanritzen & Delta Dredging Co., Pittsburg, $66,273; A. Soda & Son, Oakland, $66,476; M. B. McGowan, Inc., San Francisco, $68,433. Contract awarded to Rocca & Co., San Rafael, $55,917.

SANTA CRUZ COUNTY—Between Davenport and Santa Cruz-San Mateo county line, a bridge across Scott Creek and a culvert across Mill Creek. District IV, Route 56, Section C. Peter J. McHugh, Sacramento, $11,819; A. Soda & Son. Oakland, $11,773; F. O. Bohnett Co., Campbell, $11,568. Contract awarded to Earl W. Heple, San Jose, $11,248.50.

SHASTA COUNTY—Between Shasta and Redding, about 4.7 miles graded and surfaced with crusher run base and plant-mix. District II, Route 20, Section B. Hemstreet & Bell, Marysville, $191,271; Louis Biasotto & Son, Stockton, $206,663; George Pollock Company, Sacramento, $229,319; Union Paving Co., San Francisco, $248,804; P. L. Crooks & Co., Inc., Portland, $198,778; Guy F. Atkinson Company, San Francisco, $243,402; A. Teichert & Son, Inc., Sacramento, $177,891. Contract awarded to D. McDonald, Sacramento, $163,019.60.

SOLANO COUNTY—Between Denverton and Rio Vista. Widening about 11.9 miles existing roadbed, placing untreated crushed gravel or stone borders and armor coating. District X, Route 53, Section B. D. McDonald, Sacramento, $94,481; Heafy-Moore Co., Oakland, $85,630; Pacific States Construction Co., San Francisco, $86,253; A. G. Raisch, San Francisco, $76,713; Jones and King, Hayward, $77,758. Contract awarded to L. C. Seidel, Oakland, $72,459.

TULARE COUNTY—Between 0.4 and 0.7 miles north of Elda school, bridge and grading. District VI, Route 129, Section F. Contract awarded to Rexroth & Rexroth, Bakersfield, $12,488.

TULARE COUNTY—Between Kingsburg and 12.2 miles southerly, and between 0.6 miles and 2.4 miles south of Goshen Subway, about 13.8 miles. Constructing borders of plant-mixed surfacing and applying road-mix treatment to shoulders. District VI, Route 4, Section E, F. Union Paving Co., San Francisco, $63,637. Contract awarded to Hanrahan Co., San Francisco, $53,448.

TULARE COUNTY—Between 1¾ mile and 2¼ mile east of Porterville, 0.44 mile to be graded, road-mix surface treatment applied and constructing a timber bridge with concrete deck. District VI, Route 127, Section B. Peter J. McHugh, Sacramento, $17,389. Contract awarded to N. M. Ball Sons, Berkeley.

TULARE COUNTY—Between Olive School and one-fourth mile east, reinforced concrete bridge, grading, road-mix surface treatment. District VI, Route 127, Section A. R. R. Bishop, Long Beach, $10,070; R. Hodgeson & Sons, Porterville, $9,625; N. M. Ball Sons, Berkeley, $8,214. Contract awarded to Peter J. McHugh, Sacramento, $8,012.50.

VENTURA COUNTY—At Teague-McKevett Crossing, about one-half mile east of Santa Paula, 0.3 miles to be graded and surfaced with plant mix. District VII, Route 79, Section B. Southwest Paving Co., Roscoe, $12,881. A. S. Vinnell Co., Los Angeles, $13,114. Kovacevich and Price, Inc., South Gate, $14,418. Oswald Bros., Los Angeles, $16,347. Contract awarded to Dimmitt and Taylor, Los Angeles, $11,447.60.

VENTURA COUNTY—One bridge across Todd Barranca, and one across Hopper Creek, both with approaches, at points 8.5 and 27.7 miles east of junction with Route 2. District VII, Route 79, Section A-C. R. E. Campbell, Long Beach, $71,259. Contract awarded to R. R. Bishop, Long Beach, $53,177.

YOLO COUNTY—Between Putah Creek and Davis, about 4.3 miles armor coat. District III, Route 6, 7, Section A, A. Claud C. Wood, Stockton, $13,160; Heafey-Moore Co., Oakland, $11,128; E. A. Forbes, San Anselmo, $10,610. Contract awarded to E. F. Hilliard, Sacramento, $9,750.

Don't Cross Double Lines--They Are Your Protection

California's Highway Patrol is giving special attention these days to motorists who cross the painted double lines on the highways. It is a point that should be stressed the year around.

Because there is some leeway for the motorist who becomes stymied on a grade, curve or hillside the tendency is to abuse that privilege. Any Sunday driver is aware of many violations in the course of a typical afternoon.

The double lines are placed at certain places on the highways where engineers, after careful study, have decided that unusual traffic hazards exist. It is unlawful to cross the lines at any time unless it can be seen that the highway ahead is entirely free of traffic. Where the lines are painted on hills or blind curves, motorists are allowed to cross over after the brow of the hill is reached and the oncoming traffic can be seen and on curves where the view is unobstructed and the highway is clear of approaching cars.

The safest plan, however, is to stay on the right hand side of the double lines until you are out of the danger zone so designated. The lines were placed there for your protection, not for your annoyance, as you may sometimes think. Chiseling drivers, to whom the lines mean nothing, should be arrested on sight. The conscientious motorist has had his attention called to the danger of the restricted areas by the announcement of the highway police. He will willingly cooperate.—*Exchange.*

Most Accidents Due to Drivers or Pedestrians

ERNEST Lieberman, chief engineer for the Illinois Division of Highways, exonerated highway design for the largest slice of responsibility for traffic accidents in rural areas and tossed it into the laps of motorists and rural highway pedestrians, in an address at the recent National Safety Council Congress in Atlantic City.

LACK OF STATISTICS

"Only recently," Lieberman said, "have ample statistics permitted authorities to give to the accident situation on rural highways the attention it deserves. Previous lack of statistics prevented realization of the seriousness of the problem, as compared with traffic accident frequency in cities."

Lieberman said that during the first eight months of 1936 about one-third of all traffic accident deaths occurred in "strictly rural areas" and pointed out that in 1935 about two-thirds or 25,000 of the 37,000 total of fatalities were suffered in accidents occurring in cities of less than 10,000 population and in rural areas.

"Statistical studies of conditions that caused these accidents," he said, "show definitely that while some were due to poor road design, the driver and pedestrian were chargeable with responsibility for most of them. Consequently, it is essential that we develop a program directed toward users of the highways."

PRONE TO ACCIDENTS

The auto driver who is prone to accidents is probably the same type of man who falls off a ladder in a factory, who breaks dishes if he is a waiter, and who falls over chairs and stumbles on stairs at home, George W. Barton, of the Chicago Motor Club, told the delegates.

A driver may have as low an average as one serious accident every five years and still be classified as accident-prone, according to Mr. Barton, who contrasted this record with the average noncommercial driver, who has one accident of some severity about once every 50 years.

STATE OF CALIFORNIA

Department of Public Works

Headquarters: Public Works Building, Eleventh and P Sts., Sacramento

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Official Journal of the Department of Public Works

DEC 1 1936



Cantilever Span and East Bay Approach Structure as Seen from Yerba Buena Island



Flanked by Earl Lee Kelly, Director of Public Works (left) and Chief Engineer C. H. Purcell (right), Governor Frank F. Merriam burns first barrier on Oakland side of Bay Bridge.

Burning Barriers, Governor Merriam Opens San Francisco-Oakland Bay Bridge

AN ACETYLENE torch in the hands of Governor Frank F. Merriam burned asunder a heavy chain barrier; an electric button pressed by President Roosevelt in the White House in Washington flashed the green "Go" signal and three columns of whirring automobiles sped from each shore of San Francisco Bay over six lanes of the world's greatest aerial highway—the San Francisco-Oakland Bay Bridge—a half hour after noon on November 12, 1936.

Cannons roared, bombs burst in air, sirens and whistles shrieked and massed thousands of enthusiastic citizens at the east and west approaches to the great structure blasted the welkin with their cheers.

California's long dreamed of bridge across the bay of San Francisco had become a reality.

With the formal opening of the huge span to automobile and truck traffic, the curtain rose on the highway drama of wheels over San Francisco Bay that will present a continuous performance to be enjoyed by future generations down through the centuries.

During the first 108 hours of its operation as a State Highway this record breaking bridge broke all traffic and safety records by carrying more than 250,000 autos, buses and trucks and approximately one million persons without one serious accident. Traffic experts have figured that for each 100,000 cars traveling at highway speed there are three fatal accidents in each cycle of twenty-four hours. The only mishaps were bent fenders and bumpers.

The setting of this remarkable record was attributed to the bridge's six traffic lanes, its unsurpassed night lighting system, the segregation of truck and auto traffic on different decks and efficient handling of an unprecedented traffic situation by the California Highway Patrol.

This safety record climaxed a day of thrilling events on land and sea beginning with impressively staged dedication ceremonies at both the Oakland and San Francisco plazas marked by stirring speeches by noted state and national figures, the cheering of jubilant throngs, a spectacular air show by fifteen squadrons of navy planes, a colorful marine parade by scores of gaily decorated yachts and motor boats, and roaring salutes from the big guns of the United States battle fleet anchored just south of the bridge.

San Francisco and the East Bay district celebrated the opening of the bridge with a four-day festival unequalled in the history of the state. Oakland set the pace on Armistice Day with parades, a regatta on Lake Merritt, fireworks and a great military and naval ball, curtain raiser for the long-awaited opening of the structure on November 12 and the parades, pageants and festivities that were to follow in San Francisco.

STARTED AT OAKLAND END

Official dedication ceremonies began at 10 o'clock on the morning of November 12 at the toll plaza at the eastern terminus of the bridge. Here were gathered thousands of men, women and children, many of whom had passed most of the night in their automobiles in order to be among the first to cross the bridge when it was formally thrown open. They came to hear the speeches of prominent officials, leading citizens and the builders of the huge transbay struc-



Taken from water level, this photograph shows the majestic sweep of the Bay Bridge suspension spans between San Francisco and Yerba Buena Island.

ture themselves, and to see Governor Merriam cut the chain barrier that stretched across the traffic lanes soon to be opened to them.

In front of the crowd, vividly reminding of pioneer California days and slower modes of travel were an ox-drawn cart from Sacramento, a stage coach from Auburn, a prairie schooner from Woodland, an Indian with squaw and papoose on a drag from Oroville and prospectors and their burros from Placerville.

Presiding on a speakers' platform filled with notables, Harrison S. Robinson of Oakland, president of the Financial Advisory Committee, officially started the dedication ceremonies.

"This bridge," he said, "is an inspiring example of the great things which can be accomplished when men work together—a modern miracle—a supreme achievement of human endeavor."

Mayor William J. McCracken of Oakland marvelled at what the bridge engineers had achieved.

ANOTHER WORLD WONDER

"What they have produced," he said, "is a world-wonder, significant in its economic, human and spiritual advantages to all of California."

"It is the greatest engineering feat of modern times," declared William J. Hamilton, chairman of the Alameda County board of supervisors.

Mayor E. N. Ament of Berkeley and W. J. Buchanan, chairman of the Contra Costa County Board of supervisors expressed themselves in similar vein and were followed by former Governor C. C. Young, under whose administration preliminary steps toward the building of the bridge were taken.

"Feeling that privately owned bridges had no proper place in a great publicly owned state highway system," Mr. Young said, "we laid in 1929 the legislative foundation upon which this magnificent structure has been built. A policy of public toll bridges was inaugurated. The present Toll Bridge Authority was created and given the specific task of projecting a bridge between San Francisco and Alameda counties."

MEEK'S VISIT TO WASHINGTON

Mr. Young told of the visit B. B. Meek, then Director of the Department of Public Works, made to President Hoover in Washington in the summer of 1929 and of the cooperation he obtained from the federal government in the creation of the joint State and Federal Bridge Commission.

"The commission met and organized in my office in Sacramento, October 7, 1929," Mr. Young concluded. "With the assistance of State Highway Engineer C. H. Purcell and the Department of Public Works within a year the commission had completed its study and made its report. The site had been selected. The design had been adopted. The finished product is before us.

"Hearty congratulations are due to the present State administration, which has brought this great work to so successful a conclusion. I know how happy they must be to present it to the people of California and I rejoice with them in its completion. This is a great day for all of us."

TRIBUTE TO WORKERS

The man who built the bridge, Charles H. Purcell, Chief Engineer and State Highway Engineer, followed Mr. Young. He declared that the completion of the bridge ahead of schedule and below estimated cost is "a tribute to the intelligence of the American working man, which can not be equalled by any other nation."*

"The opening of this bridge," said Earl Lee Kelly, Director of the Department of Public Works, "is the first step in eliminating the isolation of San Francisco. This isolation never will be entirely done away with until the bridge is toll free and I predict that it will be toll free in not to exceed twenty years.

"This bridge today becomes a part of our State highway system, a highway system that is equalled by none in the world. It will do much to help

* Mr. Purcell's speech in full on page 22.



Photo by Courtesy of San Francisco Examiner

Wheels over San Francisco Bay. Six traffic lanes on new bridge filled with autos. View from Yerba Buena Island to San Francisco.



The San Francisco-Oakland Bay Bridge is open for business! Photograph shows automobiles leaving toll station on Oakland side and machines from San Francisco arriving there shortly after President Roosevelt in Washington flashed by wire the "Go" signal on November 12.

the great exposition San Francisco is planning for 1939. It will bring the cities of the bay district into closer union and on this day of its dedication I am proud to sit with the Governor and distinguished guests gathered for its opening."

NO LABOR TROUBLE

Director Kelly paid a tribute to Walter Gaines, bridge foreman, for his untiring zeal and the hazardous chances he took with his men during construction of the bridge.

"I also want to express my appreciation of labor's treatment of us," said Director Kelly. "There were no labor troubles. For that I express the appreciation of the Governor and myself. Labor has been more than fair to us and I hope that we have been fair to them.

"This bridge was constructed by your highway engineers, the men who work on your highways. They are the State men who built your bridge. We did not have to employ outside engineers except in one or two instances in an advisory capacity.

"I want to express my appreciation of the untiring cooperation and wise counsel which the Governor has given to us. And I wish to thank the financial interests of San Francisco and the East Bay and the public generally for their encouragement and support."

Director Kelly expressed regret that illness prevented B. B. Meek, former Director of Public Works, from attending the dedication of the bridge "which was started under his jurisdiction."

SOUNDLY FINANCED AND BUILT

Charles Henderson, Director of the Reconstruction Finance Corporation, which loaned the money for the bridge, declared that the structure is "soundly financed and soundly built."

"Great and magnificent as this structure is," he said "it will not convey to the men, women and children crossing on its decks the unseen obstacles encountered in its building.

"Those whose engineering skill and science have created this bridge, and the men far above the water who have done the work, deserve the highest praise. It is not only a monument to the genius of Charles H. Purcell, the engineer in charge, it is a symbol of the unlimited capacity of modern men, working together through government, to unify the physical world around them.

"It is a symbol as challenging to those of us who are not scientists as the China Clipper that flies above it. Twelve minutes from San Francisco to Oakland—eighteen hours from Oakland to Honolulu.

"May we all work with equal success to unify, not alone the physical world around us, but the hearts and the goodwill of men."

High praise of the men who actually built the San Francisco-Oakland Bay Bridge was extended by former President Herbert Hoover who took an active interest in the project.

FORMER PRESIDENT SPEAKS

"I have taken great pride," said Mr. Hoover, "as a modest link in this bridge. Some 12 years ago while Secretary of Commerce I received the report of an investigation by Government engineers of this route for a bridge. They thought unfavorably of it because of military reasons. But later, as President, I was able to take up the problem again in cooperation with Governor Young and Commissioner Meek.

"Our joint commission, whose members were Mark Requa, George Cameron, Admirals Gregory and Standley, Colonels Pillsbury and Daly, Senator Breed, Professor Marx and Chief Engineer Charles Purcell, gave first favorable and practicable report on this bridge.

"Then arose the problem of the financing of such a daring project. I used this bridge and other projects as an illustration of what we could do to help unemployment during the depression and urged the Federal Government lending money for this kind of reproductive public works. Congress gave that authority to the RFC in 1932 and the financing of the bridge became a practicality.

DEVOTED WORK REQUIRED

"But let no one think these things are as easy to do as to say them. The devoted work of scores of citizens is required to make such great enter-

prise. I have perhaps had more opportunity than most to observe that service. The work of your finance committee, Mr. Leland Cutler, Mr. Robinson, Mr. Cameron and Mr. Knowland, the backing by Governors Young, Rolph and Merriam, by Lieutenant Governor Hatfield, by Earl Kelly, by Mayors of all the municipalities, all stand out.

"That this is the greatest bridge yet constructed in the world requires no repetition by me. Its construction also spans the whole advance in industrial civilization—our discoveries in science, our inventions, our increasing skill. It is the product of hundreds of years of cumulative knowledge.

DAILY RISKED LIVES

"But above them all are the engineers and workmen right here who combined all those centuries of knowledge with courage and imagination—your own chief engineer, Charles Purcell and his able assistants, Charles Andrew and Glenn Woodruff, are men whose courage and whose knowledge combine not only the product of these generations of ideas but from their own genius designed and built this bridge.

"Deserving high credit with them are the manufacturers, the contractors. But not the least was the part of these courageous men who daily risked their lives in its construction." Governor Merriam concluded the speech making. As he took his place before the michrophone on the speaker's stand, a thousand pigeons were released from cages back of the platform and soared into the air with a din of drumming wings.

The Governor said it should be a matter of gratification that the bridge was constructed for less than the estimated cost and completed far ahead of schedule.

"This bridge," the Governor said, "belongs to this generation. We built it and we shall pay for it. But in a broader sense it belongs to the generations that are to come. When the youths of today become the citizens of tomorrow they will use it without cost. Accordingly we dedicate it today to our own use and to theirs, hoping that they will receive it as a legacy of great worth and an indication of our desire to serve."

The Governor concluded his dedicatory speech by reading a poem by Evelyn Simms lauding the builders of the bridges of the world.*

When the State's Chief Executive concluded, he left the platform and with Director Kelly and Chief Engineer Purcell crossed the plaza to the toll stations where, stretched across the lanes of traffic was a heavy golden chain.

CHAIN BARRIER SEVERED

An acetylene torch was handed to the Governor who applied its searing flame to the center links of the chain. Overhead, two hundred navy planes in perfect mass formation roared by, huge bombs burst high in the sky releasing parachutes with American flags, sirens and whistles in Oakland and the East Bay cities added to the bedlam of noise, and the chain barrier fell apart.

The eastern end of the bridge was open to the traffic that soon was to flood over it to San Francisco.

Hastening to automobiles, the Governor and his official party sped across the bridge to the San Francisco approach, where another chain barred their way.

The Governor alighted from his car and surrounded by his party again wielded a blow torch, severing this second golden chain.

IMPRESSIVE MARINE PARADE

In the bay, far below the center towers of the bridge, several hundred yachts, fishing boats and other water craft, brilliantly beribboned and with flags flying, were passing in the greatest marine parade San Francisco ever has witnessed.

* See Governor's speech in full on page 14.

(Continued on page 9)



While notables who participated in the dedication ceremonies look on, Governor Frank F. Merriam severs the golden chain barrier at the San Francisco end of the San Francisco-Oakland Bay Bridge. Left to right: Charles H. Purcell, Chief Engineer; former President Herbert Hoover; Mayor W. J. McCracken of Oakland; the Governor; Charles Henderson, Director of Reconstruction Finance Corporation; Senator William G. McAdoo, and Earl Lee Kelly, Director of Public Works.

Chief Engineer Purcell Tells Construction Story of the Bridge

BY C. H. PURCELL
Chief Engineer and State Highway Engineer

FOR 85 years San Franciscans dreamed of a great bridge that would bring closer to them the East Bay Empire and the vast and wealthy hinterland which speeded the progress and development of the prosperous cities of Oakland, Berkeley and Alameda.

Long ago men of brains and money joined with a madman "Emperor" Norton in visioning a giant structure across their beloved bay.

It was William Walker, a militant San Francisco newspaper editor, who, as early as 1850, proposed the construction of a causeway from his city to Contra Costa County. He had in mind as a precedent the famous 2000 foot Clay Street wharf, some of whose foundations reached a depth of 40 feet.

SHERMAN REVIVED IDEA

His plan was received with enthusiasm, but nothing came of it. Six years later, General William Tecumseh Sherman of Civil War fame, then a youthful banker in San Francisco, revived the idea.

In 1869 when the continent was spanned by the Central Pacific and Union Pacific railroads Leland Stanford, later United States Senator from California, joined San Franciscans in urging his railway associates to do something about bridging the bay.

These bridge proponents were practical men, but even before some of them gave serious thought to the great idea, the mad "Emperor" Norton, worshipped for his eccentricities by fun-loving San Franciscans, had demanded of the Central Pacific that it build a suspension bridge from San Francisco to his "summer capital" in Oakland.

TUBE PLAN CONSIDERED

It was not until 1921 that definite plans for a San Francisco-Oakland Bay Bridge began to take form. In that year the San Francisco Motor Car Dealers Association contributed money to defray the cost of an engineering report on the feasibility of building a combined tube and concrete causeway which would connect the City by the Golden Gate with its East Bay neighbors.

Seven years later the Board of Supervisors of San Francisco had before it thirty-five proposals for different kinds of bridges and tubes submitted by corporations and individuals. In 1928 a bill was introduced in Congress authorizing San Francisco to construct a bridge across the bay and delegations from San Francisco and the East Bay cities headed by James Rolph Jr., then mayor of San Francisco, went to Washington to urge passage of the measure.

ARMY AND NAVY OBJECTED

Objections raised by Army and Navy officials defeated the plan.

It became apparent that the bridge would have to be built by the State of California and in 1929 the legislature created the California Toll Bridge Authority. In June, 1932, Congressional approval of a loan from the Reconstruction Finance Corporation to the State was obtained and thirteen months later actual construction of the San Francisco-Oakland Bay Bridge began.

On July 9, 1933, first ground was broken for the bridge.

On November 12, 1936, the structure was opened to automobile and truck traffic.

The three years and five months intervening were full of intensive and interesting work for all of us who have had the honor to be connected with the construction of this gigantic span.

The project on the whole progressed smoothly according to schedule and without serious delay.

For example, on July 6, 1935, spinning was started on the first strands of the north and south cables of the West Bay Crossing. The steel arch girders of the tunnel were being placed, while on the East section steel work was in process of erection only as far as E-33 to E-23.

SEVENTEEN MONTHS RECORD

This means that in seventeen months the cables were spun, the steel erected, paving placed, and the structure painted for the two miles of the West Bay Crossing on two decks; the tunnel, largest bore ever attempted, was lined with concrete, excavated, the flooring of the decks placed, and the upper deck roofing relined with tile; while on the East side the cantilever span, unequaled in length by any in the United States, was erected; and the entire East side paved and painted.

Simultaneously the San Francisco approaches and all of the East Bay approaches were completed from University Avenue on the north to Cypress Avenue and Seventh on the south and 38th Avenue and Market Street on the East.

It was a gigantic task, and one necessarily coordinated to have brought about the completion of this bridge at the designated time. For this thanks are due to the cooperation of Governor Frank F. Merriam, chairman of the California Toll Bridge Authority; State Director of Public Works Earl Lee Kelly; Bridge Engineer Charles E. Andrew; Design Engineer Glenn B. Woodruff; our fine engineering staff; and our contractors and their able workmen.

TWO CAISSONS TIPPED

Aside from the tipping of the caissons W-6 and W-4 in the earlier stages of the work in constructing the foundations, we had no mishaps that caused delay other than those provided for in our schedule.

Picture of Chief Engineer C. H. Purcell reproduced through courtesy of California Magazine of Pacific Business.

Probably the only other one occurred in September, 1935, when the 23d cable strand of the south cable became twisted and had to be respun.

Toward the middle of October, 1935, the spinning of the north cable of the West Suspension spans (between the San Francisco and Center Anchorages) was completed. On the following week spinning of the south cable was completed (October 16, at 8.30 p.m.) and equipment erected at the Yerba Buena Anchorage for work on the East Suspension Spans.

In the same week all of the steel girders of the tunnel were erected and the last concrete of the roof was poured.

A HAZARDOUS TASK

Meanwhile work was progressing on the East and West cantilever arms of the East Bay Crossing, with the hazardous task of erecting the 1400-foot cantilever span itself imminent.

Scarcely one month after the spinning of the cables had been completed on the west suspension spans, the cables of this section were squeezed and bound every three feet. That same week work started on the spinning of the mile long cables on the east suspension spans from the Center Anchorage to Yerba Buena Island.

Actual starting time of the spinning of the south cable of this section was at 8 a.m., November 12, 1935, exactly one year from the time the bridge is open to traffic.

Six days later the entire core of the great tunnel had been excavated.

On December 9, 1935, the Folger Avenue Underpass was completed, one of the features of the Berkeley approach to the bridge.

FIRST SUSPENDERS PLACED

On December 16, 1935, the first of the suspended cables was placed and lifting struts were rigged up preparatory to erecting the deck steel.

Four days after the New Year (January 5, 1936) the first of the deck steel was erected for the suspension spans. In the same week the second panel of the East cantilever arm was placed.

At 10 o'clock, the morning of January 20, 1936, the spinning wheel made its last trip over the north cable of the east suspension spans, completing all spinning six and one-half months after operations were first started. In this time 17,464 wires had been placed in each cable, having a total length of 70,815 miles.

On March 2, 1936, cable wrapping first started at a point between the San Francisco Anchorage and Pier W-1, while on the East Bay Crossing the gap between the east and west arms of the cantilever span was slowly lessening.

The last main unit of the deck steel between Pier W-1 and the Center Anchorage was erected on March 10, 1936, approximately four months after the first truss was lifted in this section.

CANTILEVER SPAN CLOSED

Early on the morning of March 21, commuters were startled to see tiny spider-like figures dangling on the suspender rope, hundreds of feet above the Bay. These were painters applying the first coat to the suspenders at spans W-1 and W-2.

On that same morning only two panels remained to be erected on the East Bay Crossing before the cantilever span would be closed.

On March 25, 1936, at 4.30 p.m., the cantilever span was closed, although to the public the first eyebar thrown across the gap early Monday morning on March 24 achieved the purpose.

Next to the sinking and anchoring of the caissons, the closing of the cantilever was probably the most ticklish job in the construction of this world's largest bridge.

First, it was the longest cantilever to be suspended and the heaviest; 1400 feet in its total length; it weighed 21,000 tons. Second, changing weather and tidal conditions made the closing of the gap difficult to calculate to a nicety.

DIFFERENCE OF FOUR INCHES

At one time during the closing, for instance, with a cold wind blowing through the Golden Gate on the west and a warm sun on the east, one side of the structure was as much as four inches longer than the other.

From Tower E-2 near Yerba Buena Island and from Tower E-2 east of it, traveling derricks had moved slowly toward each other, lifting steel members from barges approximately 195 feet below. Week after week bridgemen fitted these steel members and bolted them into place until 625 feet of steel, weighing around 10,000 tons, were suspended from each tower. It remained then to close the gap of 96 feet.

It was the eyebars of the lower chord that were slipped into place early one morning which the commuters considered closed the gap, but not so spectacular but even more exciting to engineers and certainly more exacting was the completion of the final closure.

Following the placing of the lower eyebars and steel members (such as horizontals), sufficient to give the structure support but the minimum weight, four steel pins—about one-half ton in weight and three feet in length—were to be driven and the upper chords placed and bolted.

BRIDGE MOVED BY JACKS

Here eight giant hydraulic jacks, each exerting a "push" of 500 tons, which had been temporarily installed for just this purpose, came into play. Four of these jacks were located at the top of the split steel bent on Tower E. With these it was possible to push or pull an entire half of the bridge east or west. It was these horizontal jacks, 1200 feet away, that jockeyed the eyebars into position so that the steel pins could be driven through, thus securely fastening the lower chords.

The four remaining jacks with a longitudinal action had been placed at each end of the upper chords of the cantilever arms.

It was now necessary to bring these into operation to adjust the arms of the cantilever so that the upper chord could be slipped into place and bolted. This was done just as we had calculated, and not until then was the bridge closed.

Operations during the entire procedure were directed by engineers stationed with a full view of the project through telephonic communication to operators on the jacks several hundred feet away.

WORK PROGRESSED STEADILY

After the closing of the cantilever, work continued there with the erection of additional steel members and the winding up of all riveting on the East Bay Crossing. Meanwhile, the placing of paving on both decks had been under way for some weeks over that area which had been completed east of the Island and west of the bridge head.

Work progressed on the West Bay Crossing steadily but less sensation-



This night photograph shows the excellent visibility afforded under all weather conditions by the new sodium vapor lighting system.

ally as the lifting of deck trusses continued. At the same time construction of the San Francisco viaduct was nearing completion while work elsewhere was continuing at the San Francisco anchorage, Yerba Buena anchorage and viaduct, the Yerba Buena spans, East Portal of the tunnel and the San Pablo Underpass, arterial of one of the three principal East Bay approaches.

First light standards were erected as early as April 18, 1936, when poles were placed on the north and south railings of the San Francisco approach.

Erection of major steel for the continuous spans on the West Bay Crossing was completed April 14, 1936.

At two o'clock Monday afternoon, April 20, the last of the main units of the stiffening trusses of the suspension spans was lifted, carrying its American flag, symbol of work completed.

On May 27 the first machine was driven across the lower deck of the East Bay Crossing, with the curing of the last concrete to be poured in that section.

Last concrete of the entire East Bay Crossing was placed on the upper deck on June 1, approximately three months after the closing of the cantilever.

First concrete of the upper deck of the suspension spans of the West Bay Crossing was poured just after sunrise on June 18, two weeks after the completion of concreting operations, on the east side.

CONCRETE RECORD SET

This work continued rapidly, with a new record for concrete pouring established on August 20, when 750 feet of paving was placed in one day.

On August 28, the last steel floor beam of the west bridge was erected at the west end of the San Francisco anchorage, completing all major steel work.

The last batch of concrete on the entire structure was placed in the lining of the upper deck of the Yerba Buena tunnel. The bridge was ready to take care of vehicular traffic on November 12.

There remains only the installation of electric railway facilities and the erection of the terminal in San Francisco for train traffic. This in itself is a mammoth task, which we expect to finish in the spring of 1938.

The engineers and those connected with the construction of this great bridge have worked long and hard during these past three years. We now turn the structure over to the people for their use.

President Roosevelt Switches on Signal Starting Traffic

(Continued from page 5)

Meanwhile, the great siren on the Ferry Building and hundreds of factory whistles throughout San Francisco were adding to the chorus of thousands of cheering San Franciscans gathered at the Fifth Street plaza between Harrison and Bryant streets.

The ceremony of severing the second barrier finished, Governor Merriam led his party to a speaker's platform erected at the western end of the plaza.

Here Leland Cutler, president of the Golden Gate International Exposition of 1939 and vice president of the Finance Advisory Committee, presided and, after an invocation delivered by Monsignor Ramm, introduced Mayor Angelo Rossi of San Francisco.

SYMBOL OF PROGRESS

"This bridge," said Mayor Rossi, "is a sample of the West to come, a signal for renewed civic effort, a proof that the pioneer spirit of San Francisco still lives. This magnificent structure will serve to unite us more closely with our friendly neighbors across the bay and means progress for all of us."

Lieutenant Governor George J. Hatfield said that to him the great structure looming up majestically before him is "the greatest triumph in bridge engineering the world has ever seen—an opening gateway to a new Manhattan of the Pacific—a splendid, miraculous realization of the California of today."

And United States Senator William Gibbs McAdoo said:

"This bridge is a bridge of national implications—an imposing tribute to the genius of our people and the progress of our times—a great miracle."

REMEMBER MARTYR WORKERS

Walter Gaines, assistant bridge foreman and worker, wearing the steel helmet which he wore daily during the years the bridge was under construction, urged San Franciscans not to forget the men who died in the performance of their duty while engaged in work on the great span.

"Regard this bridge as a tribute to the American working man, both skilled and unskilled," he said.

Other speakers, including Governor Merriam, Director of Public Works Kelly and Chief Engineer Purcell, cut their speeches on the San Francisco side short due to the imminence of the moment when President Roosevelt would press the electric button in Washington which would throw open the bridge to the public.

The Governor read a number of telegrams from prominent national labor leaders in which the latter sent their felicitations and expressed their pleasure over the amicable relations which existed between labor and the bridge builders throughout the period of construction.

Statistical Facts of Piers, Towers, Spans and Cables

San Francisco-Oakland Bay Bridge has:

Two west bay towers of 474 feet and two of 519 feet.

Six west bay piers of 100 to 240 feet depth, and 22 east bay piers of 50 to 242 feet depth.

Two 2310-foot center suspension spans and two 1160-foot side spans in the west bay crossing.

Center anchorage 300 feet high.

Vertical clearances of 200 feet at center span and 216 feet at anchorage.

Two $28\frac{3}{8}$-inch cables, each containing 17,464 wires.

Cantilever span of 1400 feet in the east bay crossing.

Two decks—a six-lane upper deck for fast traffic; a lower deck of three truck lanes and two interurban track lines.

Tunnel carrying the decks through Yerba Buena Island, 76 feet wide by 58 feet high.

DRAMATIC ACT BY PRESIDENT

With one eye on his watch, Governor Merriam concluded his remarks with these words:

"At this minute the President of the United States is seated at his desk in the White House. In a few seconds he will press an electric switch. Turn around all of you and look at the signal tower. Soon the red light will turn to orange and then to green. Ah! There it goes. I now declare the San Francisco-Oakland Bay Bridge officially opened."

It was a dramatic moment. A dramatic, stirring scene. As the light on the signal tower flashed from orange to green cheers from thousands of throats swelled into the air, whistles and sirens screeched and down on navy row big guns boomed a salute.

Governor Merriam and his party hastened from the platform, crossed the plaza to their waiting cars on the western approach, where Chief E. Raymond Cato of the California Highway Patrol, and Captain Charles Goff of the San Francisco police traffic department and their men were holding back the eager motorists who wished to make their first bridge crossing.

AN UNFORGETTABLE SIGHT

The Governor and his party entered their cars and flashed away toward Oakland, followed by a stream of cars that steadily throughout the day and night mounted into the thousands.

On the Oakland side a similar flood of machines at that identical moment was sweeping over the eastern approaches, headed for San Francisco.

It was an unforgettable sight when the two streams of automobiles met and passed on their respective lanes in the middle of the giant structure that is the San Francisco-Oakland Bay Bridge.

Governor Merriam and party proceeded from the eastern terminus to the Hotel Oakland where they were guests at luncheon of the City of Oakland under the auspices of the Junior Chamber of Commerce.

BRIDGE BATHED IN LIGHT

The night of November 12 in San Francisco ever will be a memorable one.

When darkness fell the huge bay bridge that had loomed up in the dusk as a great silvery span across the bay suddenly became aflame with light as the sodium vapor lamps spaced along the upper deck from the Oakland plaza to the curving ramps of the San Francisco approaches burst into fire.

(Continued on page 28)

Construction Records Made by Perfect Coordination

BY CHARLES E. ANDREW, Bridge Engineer
San Francisco - Oakland Bay Bridge

THE FIRST and major stage of construction of the San Francisco-Oakland Bay Bridge is now a reality. More than 200,000 automobiles passed over its roadway during the first 84 hours of operation in orderly fashion and without mishap.

It is a wonderful satisfaction to the engineers and contractors who have toiled with untiring energy for several years to bring this great project to completion at a cost well within the first estimates made in 1929, and several months ahead of contract schedules.

The general public can not possibly realize the great amount of detail, hard work and long hours necessary in the planning and execution of such a structure.

We are proud of the fact that the world's greatest bridge has been wholly designed and constructed under the supervision and direction of employees of the Department of Public Works of the State of California. No finer or more efficient organization has ever been assembled. Too much credit can not be given to every member of the staff. All have worked long hours when necessary and have given their best.

They have (so to speak) been out in the front line trenches. Coordination of effort, both on the part of engineers and contractors has been the secret of success. Engineers have constantly exhorted and assisted contractors to keep their work planned to the minutest detail and the contractors have responded with the finest equipment and skill ever before assembled on a bridge project.

Some 15 major contracts have been so synchronized that each one has been completed in such unison as to cause practically no delay to the succeeding contract.



C. E. ANDREW

Such proper sequence is only arrived at by careful scheduling of contract dates and correct estimation of time required followed by almost exact performance on the part of contractors.

The bridge as it stands today is evidence of almost perfect performance on the part of all engineers and contractors.

Mabel—Do you think it is right to kiss a boy friend goodnight?
Marie—It is if there isn't any other way to get rid of him.

Mrs. Gabber—I've had such a cold I was unable to speak for three whole days.
Mrs. Blabber—Why you poor dear. How you must have suffered.

First Batter-leg Towers on Major Suspension Spans

ADDING a new chapter to the history of bridge construction, the towers supporting the double suspension span forming the San Francisco-Yerba Buena section of the Bay Bridge are the first "batter-leg" towers ever used in a major suspension bridge.

Each tower leg inclines inward toward the other and tapers toward the top. In designing them, the engineers were faced with the problem of flexibility. Under extreme load conditions, there will be a longitudinal movement of the bridge—either east or west—of six feet, six inches at the top of tower W-2, near the western end of the bridge. With such movement, a flexible tower was required.

WALL CELLS IN TOWERS

As designed and built, the towers consist of two columns joined by diagonal bracing. They are 109 feet wide at the base, tapering up to 78 feet in width at the top. Each tower leg covers a cross-shaped area of 32 by 19 feet at the base, and contains 21 small wall cells, or rooms, separated by silicon steel plate. The number of cells is reduced to nine just below the top.

Stresses in the towers were calculated for transverse loading, from a 90-mile-an-hour wind and from earthquake. Transverse stresses from earthquakes are comparatively small in a suspension bridge. Experts have said there is no need for fear that the bridge ever will be seriously damaged by earthquake.

ALLOWANCE FOR SWAY

The roadways over the truss spans of the bridge are attached to the towers by means of anchor arms, allowing for the required play. A rectangular slot in the lower roadway strut in each tower provides for a wind resistance connection to the span.

The two outer towers, those proximate to Rincon Hill in San Francisco and Yerba Buena Island, rise 474 feet from the top of their concrete piers, which in turn are 40 feet above the bay waters. The inner towers, on either side of the great center anchorage, are 519 feet high.



This view looking east on the bridge from the Fifth Street Plaza in San Francisco shows auto traffic coming and going over main western approach.

TRAFFIC DISTRIBUTION IN SAN FRANCISCO NOW CENTERING AT FIFTH STREET PLAZA

NOT THE least of the problems confronting the builders of the San Francisco-Oakland Bay Bridge was that of getting traffic onto and off the structure on the San Francisco side.

Western approaches had to be constructed through a large industrial district and the building of "on" and "off" ramps was a big task in itself. Projected rights of way were occupied by many types of buildings, from frame dwellings to four-story concrete and brick buildings. All had to be demolished and the property upon which they stood acquired. In all two hundred and sixteen separate parcels of real estate had to be purchased, and the acquisition of some of them required litigation.

A number of streets had to be realigned, Rincon Hill was razed, railroad and street car tracks moved and viaducts built.

The San Francisco distribution center is in a plaza embracing an area of 121,000 square feet at Fifth Street, between Harrison and Bryant streets. All of it will be landscaped, sixty-four thousand feet of it being planted to grass.

Two roadways lead to the bridge, one diagonally to the main roadway from the corner of Fifth and Bryant streets, and the other completing a triangle from Fifth and Harrison, with Fifth Street as the base.

The main approach is a single-deck structure on a 3.6 per cent grade from ground level to bridge level and consists of a series of 51 concrete two-girder spans, varying in length from 50 feet on Rincon Hill to 93 feet over Second, Third and Fourth streets. The roadway width is 58 feet throughout.

An "on" ramp and an "off" ramp constitute two branches from the main approach for vehicular traffic.

The "on" ramp leaves ground level on Fremont street just south of Harrison, its 20-foot roadway curving on easy grades upward on twenty-one 45-foot spans to a juncture with the main approach approximately at Sterling Street.

Leaving the main approach at span 46, or Rincon Street, the "off" ramp curves downward to First and Clementina streets.

Bridge a Mighty Symbol of California Genius and Vision

BY EARL LEE KELLY, State Director of Public Works

TO ME the San Francisco-Oakland Bay Bridge is a mighty symbol of California achievement and a great State's faith in its splendid future.

It has been a tremendous project, unequaled by anything of its kind in the world and its successful completion is due to the combined efforts of the communities of San Francisco, and the East Bay, the State of California and the Federal Government.

The whole State, I am sure, feels as much pride in this great bridge as do the cities of the Bay area, for it must be regarded as an important part of our State's highway system and as such is of paramount interest to every citizen; particularly because it is built without one dollar of cost to the taxpayers.

VAST PUBLIC PROJECT

While the proposition of spanning the Bay was discussed long before any of us can remember, nothing much was ever done about it because it was naturally a public project, too big to be handled by any private interests. Yet when the possibility of its construction began to crystallize into definite form a few years ago, we had about thirty-five propositions from private corporations and individuals who wanted franchises, but it was realized that none of them could successfully carry out such a vast undertaking.

So the big job was laid in the lap of the State and became a problem of the Department of Public Works and while we are rejoicing that the broad expanse of San Francisco Bay has at last been bridged, let us look back briefly at some of the historical events that led to this epochal accomplishment.

While the idea of bridging the Bay seems to have been a topic of conversation among San Franciscans ever since the city existed, it was not until the spring of 1929 when the State legislature created the California Toll Bridge Authority Act "to authorize and direct the Department of Public Works to build, purchase, condemn, or otherwise acquire for the State of California, toll bridges, toll highways, crossings and approaches thereto across waters within the State * * *" that California as a whole became a party to the project.



EARL LEE KELLY

JOINT COMMITTEE APPOINTED

The passage of this act was followed by the appointment of a joint Federal-State committee in the fall of the same year, which reported after intensive study that a bridge could be built at a cost not too great to be paid off by tolls with interest over a period of twenty years.

This committee, known also as the Hoover-Young commission, recommended the general design, specifications and route of the bridge. These have been altered somewhat in the completed plans of the present bridge but they provided a very definite basis upon which to proceed.

The cities of San Francisco and Oakland appropriated money toward test borings; the Army and Navy withdrew objections to the bridge as a bar to navigation and a menace to defense; and on February 20, 1931, Congress granted the State of California the right to construct a bridge from Rincon Hill, San Francisco, to Yerba Buena Island to Oakland.

ROLPH SIGNED APPROPRIATION

Governor James Rolph, Jr., signed amendments to the California Toll Bridge Authority Act to provide for the financing of state-owned bridges by revenue bonds on May 25, 1931, and simultaneously signed an appropriation of $650,000 for the creation of the San Francisco-Oakland Bay Bridge Division of the State Department of Public Works.

This division got down to business on September 15, 1931, when it opened offices at No. 500 Sansome Street, San Francisco, which its staff after over five years of hard and anxious labor will vacate when their work is accomplished.

Charles H. Purcell, state highway engineer, was appointed chief engineer of the bridge, and to Mr. Purcell and his fine work, sincere tribute must be paid.

NAVY GRANTS DEED

Next of importance was the permit to cross Yerba Buena Island granted the State in January, 1932, by the secretaries of War, Navy and Commerce, and the presentation of a deed to the right of way to Governor Rolph by Rear Admiral William Carey Cole, on February 25.



These men as members of the California Toll Bridge Authority, direct the affairs of the Bay Bridge. Left to right: Harry A. Hopkins, chairman California Highway Commission; Arlin E. Stockburger, State Finance Director; Governor Frank F. Merriam; Lieutenant Governor George J. Hatfield; Earl Lee Kelly, Director of Public Works.

Our next problem was the old one —money. The private bond market was gloomy, because the depression had dealt it a bad blow. After much negotiation with the Reconstruction Finance Corporation it agreed on October 10, 1932, to purchase $61,-400,000 of California Toll Bridge Authority bonds for the construction of the bridge proper, providing that the State would maintain the bridge and build the approaches.

Bids for the first contract were opened on February 28, 1933, by Governor Rolph in Sacramento. The R. F .C. announced the money available on April 27, 1933, and ground was broken on July 9, 1933.

AMAZING CONSTRUCTION PROGRESS

Thus in three years and five months the world's greatest bridge has been built and, considering the magnitude of the task and the engineering pioneering required, its quiet, steady progress has been indeed amazing.

It can not be said that the bridge is entirely completed because the electric railway system and the terminal have yet to be finished. This work will be ready by March, 1938, it is estimated.

The bridge will have an automobile capacity of 16,000 vehicles an hour without congestion. More than 30,000,000 passenger cars and trucks can pass over it a year without straining its capacity to handle traffic. The engineers have designed the bridge to accomodate a traffic volume of motor vehicles and interurban trains and passengers far beyond the estimated requirements in 1975.

65,000,000 PASSENGERS IN 1950

By 1950 we estimate the bridge will be carrying 12,600,000 automobiles and trucks, 25,000,000 motor vehicle passengers and 40,000,000 interurban train passengers.

It will save the interurban train passengers at least 15 minutes a trip, and automobile passengers a half hour or more. This time saving alone would make the bridge worth while. Figure out the amount of time saved by a commuter, multiply it by the number of passengers a year, and then try to figure out the total amount of time saved in a year. The result will be almost an astronomical figure.

Yes, the bridge will be a great break for the commuter from the time standpoint, and that alone would make it worth while. Surely the Bay commuters deserve this break.

Time saving is not the only advantage the commuter will eventually reap from the bridge, however. There is the financial advantage. It will save commuters and motorists hundreds of thousand dollars in lower fares and tolls. Keep this fact also in mind as supremely important—the bridge is being built without one dollar of cost to the taxpayers. It will be paid for out of revenue only.

The flat rate toll has been fixed at 65 cents per car and 5 passengers. This, however, may be adjusted according to revenues. A larger volume of traffic than we anticipate would most likely result in lower toll charges.

But according to our most careful estimates, the bridge should pay for itself in about 20 years.

After that it will become a FREE BRIDGE!

When I say that its construction will not cost the taxpayer a dollar, I am, of course, referring to the bridge proper; the approaches will be paid for out of northern California's share of the State gasoline tax allotment. But this amounts to only $6,600,000 and will be repaid out of bridge revenues.

The importance of this great new bridge unit as a connecting link of our State Highway System is emphasized by a glance at the map re-

(Continued on page 20)

Governor Merriam at Dedication Pays Tribute to Workers and Looks Forward to a Free Toll Bridge

Two addresses were delivered by Governor Frank F. Merriam in the dedication exercises, the first at the Oakland terminus and the second at the San Francisco end.

In his Oakland address, the Governor paid tribute to the civic leaders, government and State officials and the army of workers who made the bridge possible. He looked forward to the time when the great structure will be owned by the people of California and be toll free.

The Governor in San Francisco emphasized the great strides made in the development of California and expressed his gratification that the bridge had been constructed for less than the estimated cost and ahead of schedule.

Governor Cites Ideals In San Francisco Speech

Governor Merriam said in San Francisco:

We have assembled upon this occasion to celebrate the completion of this great bridge. In so doing, we are following a custom that has marked the progress of highway construction throughout the Nation. The building of bridges has always stimulated the interest and aroused the enthusiasm of our people. But never had any group a greater incentive for celebration than have we because we are dedicating a bridge of stupendous construction, magnificent design, marvelous beauty, amazing strength and, withal, a capacity for unlimited service.

Our meeting today will do more than celebrate the completion of this project. In a broader sense, we must recognize this as a day of commencement rather than a day of attainment. In the past we have been interested in its construction, in the future we shall be interested in its use.



GOVERNOR FRANK F. MERRIAM

HARD WORK STRESSED

For more than three years engineers, construction corporations and workmen all under the Department of Public Works of the State of California, have been working together in this building program. This gigantic structure required the best thought and concentrated effort of some of the leading engineers of our State and Nation. It involved the formation of fiscal policies that demanded the highest ingenuity of outstanding financial leaders. Moreover, it required the devoted service of thousands of men who labored daily in placing the materials and in operating the machinery.

This, then, is a monument to the combined efforts of governmental authorities, construction experts, architectural engineers, skillful workmen and a cooperative people. It is the result of the broad vision and the heroic efforts of courageous men.

TWO THEORIES CITED

We can not dedicate this bridge without noting the remarkable advancement of the last 300 years. In reviewing that history we discover that our progress has evolved out of the common struggles of men. In the records covering these few centuries we find two threads of philosophy that run through the whole fabric of American life. The one expounds the theory of isolation, the other extols the ideal of cooperation.

In the formation of one of the early communities on the Atlantic Coast, the local government assumed the responsibility of providing every person with a musket, one pound of powder, twenty bullets and two fathoms of match, with sword and rest and bandoliers. This was in a period when the rivers, marshes and mountains served as barriers of protection and security. Throughout the centuries they had stimulated the organization of the clan, the tribe or the village.

CREEDS BECOME STATIC

Obviously people living under such circumstances were deprived of the stimulus that comes from contact with other people and other races. This ideal of isolation prevented the extension of knowledge and the development of the spirit of service. Creeds, customs and conventions became static. Even habits of thought and the expression of ideas became stilted and circumscribed.

In striking contrast to that type of civilization we survey our own. In analyzing the qualities and characteristics of this great bay area we discover many factors that create common interest among the residents. They are held together by bonds of education, religion, government and



Section of huge crowd attending Bay Bridge dedication ceremonies on Oakland side, with Administration Building in background.



Scene at Fifth Street Plaza in San Francisco where thousands of enthusiastic persons gathered to hear dedication speakers.



Speakers platform in Fifth Street Plaza on dedication day. Lieutenant Governor George J. Hatfield is addressing throng of citizens.

social service. They share the advantages of great community enterprises, projected and maintained through public leadership and the use of public funds. This bridge which we dedicate today stands as a symbol of cooperative achievement for the residents of this local community, the State and the Nation. We have learned that isolation stimulates fear while cooperation inspires confidence. Isolation never advances commerce, business, industry and culture. It curtails rather than impels a feeling of community consideration.

EMBLEM OF FRIENDSHIP

Accordingly we dedicate this great structure as a part of the highway system of California to the use of the people in an emblem of friendship and neighborly association—an ideal which is beautifully and emphatically portrayed in the words of the poet when he said:

'I like a bridge—
'It cries "Come on
'I'll take you there from here and here from there.
'And save you time and toil."
'I like a bridge—
'It breathes romance;
'There's new adventure on the further side
'And I will help you cross.
'I like a bridge—
'It makes me think
'That when a worry comes, my mind will find
'Somewhere a friendly bridge.

Workers, Engineers Are Praised In Oakland Talk

Governor Merriam, in his speech at the Oakland end of the bridge, said:

We are privileged today to celebrate the completion of the greatest bridge yet constructed and to place it at the disposal of the multitudes who will cross and recross it as the years come and go. Never in the events of recorded years has such a bridge been built to span so great a stretch of water. The secrets of Nature, the science of their use, the art of construction and the inventive genius of man, have all contributed to this tremendous enterprise. San Francisco, Oakland, the adjoining communities, California, and the Nation may well be proud of this world renowned structure.

This bridge is not the product of a day. In the early years men gazed out upon the waters separating the peninsula from the mainland and advocated building a bridge upon which traffic might pass at will, successively a dream, a vision, a subject of scientific research, the definite engineering plans, governmental approval and financing, and finally the builders, realization—we are assembled here to inaugurate its service to mankind who may travel this way.

MANY TOOK PART

Nor has the bridge resulted from the activities of a single individual. A myriad of thinkers and workers have, through their individual and combined efforts, carried their share of the responsibility and have added their part to this great undertaking. Without the earnest cooperation of many minds and hands, this magnificent structure would not stand, at once, as the result and the instrument of modern progress.

PRESIDENTS PRAISED

Presidents Hoover and Roosevelt generally contributed to the enterprise; President Hoover in the initiation of planning and financing, and President Roosevelt in the support and aid which made possible its completion.

Governors Young and Rolph worked without reserve in promoting the enterprise—Governor Young in approving the act establishing the Toll Bridge Authority, the organization which has had immediate charge of the financing and supervision of its construction and Governor Rolph in enthusiastically carrying forward the executive activity during his term of office.

COMMISSIONS LAUDED

Two commissions, one appointed by President Hoover, the other by Governor Rolph, rendered splendid service. The first special committee, usually designated as the Hoover-Young Commission, was named to select a site, determine the route and to negotiate with the war department regarding these and other important items. The second, known as the Financial Advisory Committee, was instrumental in financing and convincing the Reconstruction Finance Corporation of the soundness of such an investment and in arranging for the sale of the revenue bonds. Both of these commissions gave generously and gratuitously of their time and ability in the advancement of the project.

Many others should be commended. Everyone, in any way connected with the work, was most zealous in his effort to be helpful. The contractors, the workmen who labored with their hands and those who operated the machinery, must all be commended for their skill and diligence. Director of Public Works Earl Lee Kelly and Chief Engineer Charles H. Purcell, rendered outstanding service in their particular lines of activity, as did their associates.

These bridge builders have looked forward with enthusiastic anticipation to this hour. In all of the processes of construction they followed a plan that had been inspired by the commanding ideal of service.

They now enjoy the results of their handiwork. Through the authority vested in the state they offer it today to the public as a masterpiece of architectural and engineering skill, a roadway between two great communities.

FINANCING CITED

While we extol the achievement of its building, and sing the praise of those who have accomplished its completion, the ulitarian and practical features which induced investors to finance the project should not be passed unnoticed. It was this decision which finally insured success.

The financing of the undertaking is as bold in the field of investment as is the project in engineering and construction. Self-liquidating, the $55,000,000 in bonds, already issued, and the $15,000,000 or $20,000,000 additional necessary to provide interurban electric car service over the bridge, are guaranteed, only by the revenues derived from its operation. The receipts and income must pay the indebtedness incurred. The taxes and credit of the cities, counties and even the State are in no wise pledged for the satisfaction of the bridge obligations. When the bonds and indebtedness have all been paid, the bridge becomes the property of the state, to be operated toll free as part of the highway system.

COST IS REDUCED

It is a matter of gratification that the bridge has been constructed for less than the estimated cost and completed in less than the time allotted under the contract.

This bridge was designed and has been constructed to improve transportation facilities, to make travel less expensive, to save time and to provide convenience, safety, and com-

(Continued on page 23)



Entrancing view of Bay Bridge showing majestic lines of structure, with San Francisco in background.







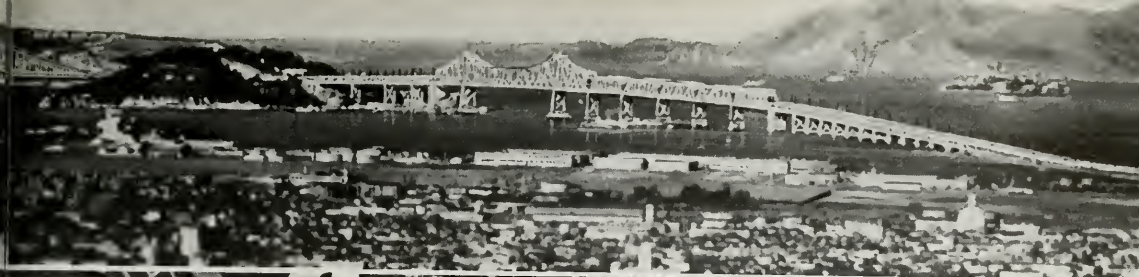


AT TOP
Panorama of entire bridge from Berkeley looking toward Golden Gate.

AT LEFT
Cantilever span and approaches and below, east suspension span approaching Yerba Buena Tunnel.



AT RIGHT
View of lower deck showing three truck lanes.







IN CENTER
Auto traffic passes through an arch of steel on top deck of cantilever spans.

AT RIGHT, ABOVE
View of upper deck through the Yerba Buena Tunnel.



AT RIGHT
Close up of main cable of east suspension span showing suspender cables and Fresnel light standard and lamp.



Main Highway Arterials Lead to Bay Crossing

(Continued from page 13)

vealing some of the traffic arterials that lead to it.

NEW HIGHWAY CONNECTION

First, there is the new East Shore highway, a portion of which was rushed to completion for the opening of the bridge. This highway, designated State Route 69, interseets with United States 40 which is also State Highway 14, in El Cerrito and traverses the tide flats to connect with U. S. 48 (State Highway Route 5) near Emeryville. It extends also southward to join Seventh Street and Cypress in Oakland.

This double highway, which features a ten-foot dividing strip, has been designed to be one of the safest in California.

U. S. 40 (Lincoln Highway) traverses San Pablo Avenue through Oakland and Berkeley and follows the shore of San Pablo Bay and the Straits of Carquinez, which it crosses to connect with State Highway Route 7. Route 7 is the link that carries traffie to the various roads covering the fertile Sacramento Valley regions.

Two recent improvements on this route, the American Canyon Cut-off from the vicinity of the Carquinez Bridge to Fairfield and the realignment south of Vacaville will shorten the driving time from Sacramento to the Bay region by a full hour.

NEW TUNNEL BUILDING

Another important project that will give easier access to a prosperous region from which traffic will flow directly over the bridge is State Highway Route 75—the road to Moraga Valley and Walnut Creek. The Broadway low level tunnel when complete will replace the old narrow tunnel east of Berkeley and considerably shorten the distance.

It is easy to visualize the great activity in motor-car travel, both industrial and pleasure, which will result in the Bay Region with the creating of such an important link in our highway chain as the San Francisco-Oakland Bay Bridge.

This structure will be maintained by the State Highway Department from gas tax funds allotted to the northern counties.

SPECIAL HIGHWAY SQUAD

Traffic regulations will be those of all State highways, with the speed limit 45 miles per hour. For the protection of motorists and to safeguard against reckless driving a special bridge detail of the California Highway Patrol has been assigned to duty within the confines of the structure operating from the Fifth Street Plaza in San Francisco to the East Bay approaches. Their quarters will be at the Administration Building. In order to expedite traffic over the bridge the Vehicle Code specifies that "on vehicular crossings" acquired under the provisions of the California Toll Bridge Authority Act, pedestrians, bicycles and animals led or driven can not be permitted.

In closing, I want to pay a tribute of appreciation and sincere admiration to the men whose brains and brawn have built this great structure. To the engineering geniuses who conceived and designed it and to the thousands of American workmen whose daring courage and skill erected it the San Francisco-Oakland Bay Bridge will be an enduring monument of steel and concrete, a memorial of high endeavor and sacrifice for future generations to gratefully contemplate.

"Say, porter, did you find a big roll of money under my pillow?"

"Yessuh. I did, suh, and I thanks you, suh, very much, suh."

Doctor: "Humph! I can't quite diagnose your case. I think it's drink."

Patient: "Oh, I see. Now, look here, doctor. Would you like me to come again when you're sober?"

Pres. Roosevelt Starts Traffic Over Bay Bridge

(Continued from page 9)

Simultaneously, searchlights on every battleship in navy row shot great beams of light into the clear night sky and for an hour wove designs in the heavens.

Against a blue-black background of the southern horizon an endless procession of automobiles moved back and forth across the bridge, their headlights giving the impression of flaming pearls in motion on an unearthly jewelled brooch stretched across the bay.

GREAT PYROTECHNIC DISPLAY

Many thousands of San Franciscans and visitors sat spellbound on every vantage point in the city for hours watching the gorgeous show of light. And to top it off, from a barge anchored in mid-bay, San Francisco staged such a display of fireworks as never before has been witnessed on the west coast.

It was a breath-taking scene.

To add to the glamour of the night, every large office building and hotel in downtown San Francisco was aflame with electric lights, each an incandescent, colorful pattern of its own.

On Friday, November 13, San Francisco staged the greatest parade in its history, and San Francisco ever has been a city that loved parades. The afternoon parade of that day, starting at the Embarcadero at 2 o'clock in the afternoon, consumed three hours in passing the reviewing stand in the Civic Center.

BRILLIANT NIGHT PAGEANT

The city gave itself over to a riot of fun and celebration ending with a huge pageant of light on Saturday night, a night parade of brilliantly illuminated floats, marching troops, sixty bands and drum corps and numerous civic and military organizations.

Tired, but still joyous, citizens of San Francisco went to their churches on Sunday morning where special services in commemoration of the realization of the city's bay bridge dream were held.

New Problems of Design Solved by Bridge Engineers

By Glenn B. Woodruff, Engineer of Design
San Francisco - Oakland Bay Bridge

THE LARGEST and deepest foundations on record, the world's largest tunnel, a new type of suspension bridge, the longest and heaviest cantilever span in the United States were among the problems that faced the designers of the Bay Bridge.

For all of these, it was necessary not only to provide a design that would be adequate when completed but to develop construction methods on which the contractors would stake their resources to accomplish what many engineers, not to speak of laymen, had declared impossible.

There was still another task, to produce such designs that this work could be accomplished within reasonable financial limits. For several parts of the work it was necessary to develop not only new designs, but also new theories of design. It is now possible to report that all these problems have been successfully solved.

DESIGN HIGHLIGHT

Among the highlights of these designs, the following may be briefly mentioned.

The Purcell-Moran caissons used for the foundations of the West Bay piers, which not only permitted carrying our foundations to rock 240 feet below water surface but also made it possible to force the cutting edge through 25 feet of sandstone.

The false bottom caissons in the East Bay, which permitted placing foundation concrete 245 feet below water, 60 feet beyond all records other than those on the bridge.

The tunnel through Yerba Buena Island, 80 feet wide, 60 feet high, with lining, and involving the new method of completing the tunnel lining before excavating the core.

The twin suspension span West Bay Crossing, with its immense center anchorage.



G. B. WOODRUFF

The East Bay cantilever, longitudinally anchored at one point only with provisions for taking all the expansion in a mile of bridge at one point.

No mention of this project can be complete without a tribute to the efficient staff of engineers, all of them employees of the State Department of Public Works, whose industry and ability have brought the project to its successful culmination.

Commuters Will Save 35,000,000 Hours per Year

WHEN electric train service is installed on the San Francisco-Oakland Bay Bridge, bay commuters will be saved approximately 35 million hours of time a year, according to Earl Lee Kelly, Director of the Department of Public Works.

This saving, figured in dollar value of time saved by commuters, ultimately will be worth almost the cost of the bridge, in the opinion of Mr. Kelly.

35,000,000 COMMUTERS

At the time the bridging of the bay began to receive serious consideration in Washington, Director Kelly ordered an exhaustive survey of commuter needs between San Francisco and the East Bay district. His engineers found that 35 million persons a year used the ferryboats and that the average trip, counting waits, consumed an hour each way.

"Our studies showed that a bridge with high-speed electric trains replacing the ferryboats would save each commuter nearly an hour a day," Director Kelly said.

ELECTRIC TRAINS PLANNED

"The next problem was that of cost to the commuter. The State's engineers and the California Toll Bridge Authority had their choice between a 'gold plate' service that would be the last word in luxury but which would be more expensive than the ferryboats, and the cheapest kind of electric train service which took no account of comfort or speed.

"The electric trains planned for the bridge are a happy medium between these two extremes. They will provide fast, comfortable service and at the same time will be sufficiently inexpensive to allow the money borrowed from the Reconstruction Finance Corporation for the interurban system to be repaid in about a score of years out of commuter fares."

Jack Tar had just arrived at the old home cottage after voyaging about for a number of years. "Well, mother," he said heartily, "how did you like the parrot I sent you?"

"Well," said his old mother dubiously, "it was nice and plump, Jack, but my! it was tough."

Bridge Built in 40 Months With Saving of Over $7,500,000

In his speech at the dedication ceremonies, Chief Engineer Charles H. Purcell of the San Francisco-Oakland Bay Bridge, who is also State Highway Engineer, paid a high tribute to the intelligence of American workmen whose skill constructed the great span in forty months with a saving of $6,000,000 under estimate and over $1,500-000 in interest on bonds. The speech in full was as follows:

BY CHARLES H. PURCELL

Chief Engineer and State Highway Engineer

THIS bridge today becomes a part of the State Highway System of California—a part of a system that has kept pace with the development of California since its establishment in 1909.

The people of California have contributed through the years to the maintenance and construction of this system which has returned to the people a service in economical transportation of the varied products of the farms, mines and industry. The highway system has done its part in lowering the cost of bringing these products to the competitive markets of the world on such a basis that California has prospered.

Into this bridge have gone the results of the combined research and experience through the years of the various engineering and scientific professions. We have in this structure contributions from the metallurgists, the mining engineers, the electrical engineers, the mechanical engineers, the chemical engineers, and the civil engineers.

TRIBUTE TO AMERICAN WORKERS

The personnel of these groups have all contributed to this structure. The rapid production of materials and the speed of assembly materials, with improved quality of workmanship, permitted the completion of this structure in the short period from July, 1933, to November 12, 1936—a period of forty months.

The intelligence of the American skilled workman, which enables a large organization to adapt itself to the newest mechanical developments, can not be equalled in any nation, and to this great body of skilled labor on this structure I am sure that the people of California are grateful. This great undertaking was carried on through the depression, under varying conditions, with no strike or serious labor dispute.



C. H. PURCELL

I feel that a word of praise is due the great contracting firms who bid upon our plans and carried them through to completion with that spirit of cooperation with the engineering staff that is essential to any successful engineering project.

SAVING OF $7,500,000

This bridge stands completed today, ready for motor transport, with a saving of over six million dollars under the estimated authorization for its construction. It is available for the use of the public six months in advance of the scheduled completion date, with a saving in cost of interest on bonds during construction of over a million and a half dollars. Total cost of the bond-financed bridge at this stage is fifty-three million six hundred thousand dollars in cash.

I wish to pay a tribute at this time to the great staff of engineers who worked so diligently and skillfully during the past five years. Often long hours of overtime have been necessary to make today's completion date possible. No chief engineer could have had a more loyal and skillful design and field force than it has been my privilege to have on this project.

I am deeply grateful to Governor Frank F. Merriam for his kindly and sound advice and for his sincere cooperation. I am indebted to Earl Lee Kelly, State Director of Public Works, for his untiring assistance and encouraging counsel.

To the Board of Consulting Engi-



Night view in Yerba Buena Island tunnel of San Francisco-Oakland Bay Bridge showing excellent lighting effects of sodium vapor lamps.

neers whom I selected for this work five years ago—whom I considered outstanding in their particular fields—I am grateful for technical advice.

I am grateful, too, for the wise counsel of the Financial Advisory Board, composed of business men who gave freely of their time and money to assist in launching and guiding the financial questions which are important in a project of this kind.

Those who were appointed to membership on the original Hoover-Young Commission can look with satisfaction upon the work which they did as a basis for this structure when the location and agreements with the Army and Navy were reached and the report made to President Hoover and Governor Young on August 6, 1930.

COOPERATION BY RFC STAFF

The businesslike decisions on all fiscal questions and technical questions arising during the progress of this work, by the Directors of the Reconstruction Finance Corporation and Chief Engineer and legal staff have contributed largely to the rapid progress and the prompt completion of this project well within the estimates.

For the patience and the kind understanding of the people of the San Francisco Bay Area we of the engineering staff are duly grateful.

Poem Quoted in Dedication Speech by Gov. Merriam

In closing his dedication speech at Oakland, Governor Merriam quoted the following poem:

'They have builded magnificent bridges
'Where the nation's highways go;
'O'er perilous mountain ridges
'And where great rivers flow.
'Wherever a link was needed between the new and the known
'They have left their marks of Progress, in iron and steel and stone.
'There was never a land too distant
'Nor ever a way too wide,
'But some man's mind, insistent,
'Reached out to the other side.
'They cleared the way, these heroes, for the march of future years.
'The march of Civilization—and they were its Pioneers.'

—Evelyn Simms

As this bridge daily carries on the work for which it is intended, we hope it will develop a character as have the venerated old bridges of the world. We hope that in time the public in this great metropolitan area around San Francisco Bay will feel the same affection towards this that they do towards their many interesting historical spots that they now treasure.

Governor Merriam Dedicates Bay Bridge

(Continued from page 16)

fort for the commuter and the visitor. In the realization of this service will the project fulfill the objective of its builders and the hope and expectations, not alone of the residents around the bay, but of all Californians.

This bridge belongs to this generation. We built it and we shall pay for it. But in a broader sense it belongs to the generations that are to come. When the youths of today become the citizens of tomorrow they will use it without cost. Accordingly, we dedicate it today to our own use and to theirs, hoping that they shall receive it as a legacy of great worth and as an indication of our desire to serve.

BRIDGE DEDICATED

May it always remain a thing of beauty and interest, an example of the genius and courage of the engineer, financier, builder and the people of California.

Cub Reporter: "I'd like some advice, please, on how to run a newspaper."

Editor: "You've come to the wrong person, son. Ask one of my subscribers."

Legal History of the Transbay Bridge Project

By C. C. CARLETON, Chief Attorney
State Department of Public Works

PURSUANT to an act of the 1927 Legislature, introduced by Senator Roy Fellom of San Francisco, providing for an investigation by the California Highway Commission of the operation of toll bridges in California, a comprehensive report was submitted by the Commission to the 1929 Legislature.

In the summary of conclusions in that report the following statement appears:

"A general conclusion is drawn that, due to the generally high cost of public service of privately owned toll bridges, and the extreme difficulty of acquiring them after they are constructed, at a value consistent with that for which the state or county could build and operate them, necessary steps should be taken to permit the state or counties to finance and build toll bridges on an income bond basis."

The report contains the following significant paragraphs:

"There have been a large number of franchises sought by different parties to bridge the waters of the San Francisco Bay district, all of which have been denied by the supervisors of the county having jurisdiction, they are:

MANY WANTED FRANCHISES

Applications for franchises to construct bridges across San Francisco Bay from the municipal district of San Francisco to that of the east bay cities. Some 33 applications have been made to San Francisco County, two to Alameda County and four to San Mateo County for such franchise. The city of San Francisco has applied to congress for a permit to build a bridge across the bay at the location proposed by its board of engineers in their report dated May, 1927."

In the year 1928 several conferences were held between State and city and county officials in which the endeavor was made to interest the State itself in undertaking the construction of such a bridge. An early legal question arose whether under the Constitution of the State of California the State, through appropriate legislative machinery, could issue revenue bonds to finance the construction without submitting such a bond issue to a vote of the people.

While such bonds were not to be intended to constitute a debt or general obligation upon the State, but to be retired solely from the earnings of the structure, yet the constitutional question became a vital one at the outset.



C. C. CARLETON

It was the first time this form of financing had been proposed to be used by the State of California, itself. However, it had been used successfully in a number of other states, notably New York, Indiana, Kentucky, Ohio and in many municipalities throughout the Nation. It was an old established method of public financing in Europe for projects of both local and general importance.

At a meeting held by interested public officials and private citizens in the State Building at San Francisco on November 20, 1928, the legal aspects of the construction and operation of the bridge connecting San Francisco with Alameda County were discussed and a legal committee appointed to study the constitutionality of the suggested revenue bond plan of financing and to draft any new legislation that might be required to be introduced in the 1929 Legislature.

This committee was composed of Frank English, Deputy Attorney General, representing Attorney General U. S. Webb, John J. O'Toole, City Attorney of San Francisco, and John J. Dailey, his assistant, representing the City and County of San Francisco, and the writer, as legal representative of the State Department of Public Works. Judge Matt I. Sullivan, former Chief Justice of California, also advised in the legislation.

The 1929 Legislature duly passed the necessary legislation, also introduced by Senator Fellom, creating a California Toll Bridge Authority and authorized the issuance of revenue bonds to build or purchase toll bridges in the State of California.

LOCATION DETERMINED 1930

The first project undertaken was the San Francisco-Oakland Bay Bridge. In 1930 the location of the bridge was determined under the direction of a special commission appointed by the President of the United States and the Governor of the State of California.

Congress passed an act granting a permit for the construction of the bridge. The 1931 Legislature of California passed an act appropriating



This photograph, looking east from the Fifth Street Plaza in San Francisco, shows the on and off ramps for both upper and lower decks of Bay Bridge. In foreground is the approach to the plaza. The artist has sketched in his conception of interurban trains using the lower deck.

$650,000 for the preparation of necessary plans and estimates.

It was determined that it would be advisable to prepare a test case in the Supreme Court of California to establish the constitutionality of the California Toll Bridge Authority Act of 1929.

CONSTITUTIONALITY UPHELD

The Supreme Court in the case of *California Toll Bridge Authority, et al.*, vs. *Wentworth, etc.*, 212 Cal. 298, upheld such constitutionality.

The Authority was represented in the proceeding by U. S. Webb, Attorney General, Robert W. Harrison, Chief Deputy Attorney General, Frank English, Deputy Attorney General, and the City and County of San Francisco by John J. O'Toole, City Attorney; John J. Dailey and the writer, of Counsel.

Special credit is due John J. Daileu, now a Deputy Attorney General of California, for the valuable contributions he made toward handling legal and legislative matters during this early period.

In 1932 requests were made to the Reconstruction Finance Corporation at Washington to aid in the financing of the San Francisco-Oakland Bay Bridge, and a formal contract and formal agreement, dated December 15, 1932, for such financing was entered into between the California Toll Bridge Authority and the Reconstruction Finance Corporation.

BOND VALIDITY ESTABLISHED

The Reconstruction Finance Corporation required as a condition precedent to the purchase of the bonds, that the validity thereof be passed upon by attorneys approved by such corporation.

The firm of Thomson, Wood & Hoffman, attorneys at law and nationally recognized bond experts of New York City, being acceptable to the Reconstruction Finance Corporation, was then employed by the California Toll Bridge Authority and have since served as the eastern bond counsel.

On December 15, 1932, the law firm of Heller, Ehrman, White & McAuliffe, of San Francisco, was employed by the Authority to render legal services in connection with the transactions with the Reconstruction Finance Corporation at Washington and litigation and legislation in California, and have since served as special counsel for the California Toll Bridge Authority.

McAULIFFE'S WORK LAUDED

F. M. McAuliffe and Lloyd W. Dinkelspiel of that firm have made numerous trips to Washington and both there and in California have rendered conscientious and conspicuous public service.

They have handled the legal work in connection with the drafting of the agreements with the railway companies for the installation of rail facilities on the new bridge.

In 1933 they also conducted the second test case entitled, "*California Toll Bridge Authority* vs. *Kelly*," 218 Cal. 7, where the Supreme Court of California again upheld the constitutionality of revenue bonds issued by the California Toll Bridge Authority.

Much legal work has also been handled by the regular legal staff of the State Division of Highways, Department of Public Works, and at all times the coordination of the work of the regular and special counsel has been complete and cordial.

It would be beyond the scope of this brief article to catalogue all the cases and problems disposed of by the legal advisers.

Considering the immensity of the San Francisco-Oakland Bay Bridge project, it is remarkable that it has been so free from vexatious and dilatory litigation.

In conclusion it is safe to assert that every attorney who has been associated in any manner in the initiation, development and accomplishment of this vast enterprise feels that he has enjoyed one of the most outstanding opportunities of his professional career.

Flat Toll Rate is 65 Cents per Car Including Driver and 4 Passengers

A FLAT base toll of 65 cents per automobile, with no charge for five passengers, including driver, and a 45 cent commutation rate will prevail on the San Francisco-Oakland Bay Bridge during the first year of its operation.

These rates were endorsed by the San Francisco-Oakland Bay Bridge Financial Advisory Committee at its meeting in San Francisco on October 28th and finally approved by the California Toll Bridge Authority at a meeting in Sacramento November 6th. They compare with the established average ferry rate of 80 cents per passenger automobile that had existed for years until the ferries recently reduced their fare to meet the bridge rate and were also approved by the Reconstruction Finance Corporation, the Federal body that advanced the funds for construction of the bridge.

Truck rates were fixed at 75 cents per truck, including driver.

RECOMMENDED BY EXPERT

The established toll rates were recommended by Chief Engineer C. H. Purcell, based on an engineering report of a thorough study of the financial requirements for amortization of bridge bonds, interest, operation, etc., made by Coverdale and Colpitts, New York traffic experts, as required by State law and an agreement between the Toll Bridge Authority and the Reconstruction Finance Corporation

The toll schedule as adopted is as follows:

1. Automobiles, ambulances, taxis, commercial or light delivery automobiles, all with driver and not to exceed 4 (four) additional passengers	**$0.65**
Passengers in excess of 4 (four) each	**.05**
2. Commute: Passenger automobiles only, with driver and not to exceed 4 (four) passengers, 50 (fifty) one-way trips in any calendar month	**22.50**
Passengers in excess of 4 (four) each	**$0.05**
3. Trailers drawn by automobiles	**.50**
Passengers riding trailer each	**.05**
4. Auto trucks (with driver)	**.75**
Passengers in excess of driver each	**.05**
5. Auto truck trailer or semitrailer	**.75**
Passengers riding trailer each	**.05**
6. Buses with driver	**.75**
Passengers in excess of driver each	**.05**
7. Motorcycle with driver	**.20**
Additional passengers each	**.05**
8. Tricar with driver	**.30**
Additional passenger	**.05**
9. Vehicles not otherwise specified and traveling under special permit per 100 pounds	**.03½**
10. Freight on all kinds of vehicles per 100 pounds	**.03½**

LARGE FREIGHT SHIPMENTS

Note: **When freight from any one individual firm or company exceeds 50 (fifty) tons daily, the charge to be 3 cents per hundred pounds. If the charge on shipments of less than 50 (fifty) tons daily at 3½ cents per hundred pounds makes a higher charge than $30, this charge of $30 will apply.**

When freight from any one individual firm or company exceeds 75 (seventy-five) tons daily, the charge to be 2½ cents per hundred pounds. If the charge on shipments of less than 75 (seventy-five) tons daily at 3 cents per hundred pounds makes a higher charge than $37.50, the charge of $37.50 will apply.

The minimum daily tonnage shall be computed as the tonnage moving between hours of 12.01 a.m. of one day to midnight of the same day.

The average cost now for an automobile entering San Francisco by ferry has been 80 cents. The flat bridge rate of 65 cents per car includes four passengers and the driver and provides free parking in San Francisco, thus eliminating the daily parking problem for hundreds of visitors and commuters.

FREE PARKING PROVIDED

Every bridge ticket will admit the car to a large parking area under the bridge structure in San Francisco up to the limit of the area capacity, which will be about two thousand cars daily.

The monthly commutation rate of $22.50 allows for 50 one-way automobile trips in a thirty-day period, or a round trip each day for 25 working days at the rate of 45 cents per single trip carrying five people.

The truck rates are fixed at 75 cents per truck regardless of size, except that all truck trailers are on a straight 75 cent rate, with no commutation rates applying.

In abolishing auto passenger tolls the bridge authority is following the prevailing practice on large bridges in the East where no charge is made for passengers in automobiles crossing the George Washington Bridge, the Delaware Bridge, or the Holland Tunnel. The additional charge of 5 cents for each occupant of the automobile above the number of five is largely made to discourage the development of a jitney service on the Bay bridge.

It is further believed that the 65 cent flat rate will greatly facilitate speedy movement of traffic, especially on heavily congested days. Drivers can readily hand out the fixed amount without the necessity of stopping for the counting of passengers and asking of questions, thus blocking the toll lanes. Having a flat rate for passengers and car permits an automatic count of the bulk of traffic, eliminating the personal equation.

Building Material Quantities

The San Francisco-Oakland Bay Bridge represents:

Structural steel	152,000 tons
Reinforcing steel	30,000 tons
Cable wire	18,500 tons
Concrete	1,000,000 cu. yds.
Cement	1,300,000 bbls.
Lumber	30,000,000 ft. b.m.
Timber Piles	800,000 lin. ft.
Asphalt	46,000 tons.
Paint	200,000 gals.
Rock wall	317,000 tons
Dredging	4,678,000 cu. yds.
Excavation	1,360,000 cu. yds.

EAST BAY DISTRIBUTION STRUCTURE INCLUDES 16 GRADE SEPARATIONS

CONSTRUCTION of the distribution structure for the East Bay approach to the San Francisco-Oakland Bay Bridge involved more engineering problems than were encountered on the San Francisco side.

Two major puzzles confronted the engineers of the Division of Highways. They were solved by the building of an intricate interlacing traffic distribution structure and by a mole fill.

The structure itself is located within the city limits of Emeryville, at the point where the fill intersects the rail lines of the Southern Pacific, Santa Fe and Key Route System. It was placed there because all these rail lines had to be crossed and it was considered best to cross them all with one structure.

DIFFICULT TRAFFIC PROBLEMS

Traffic problems which were involved and which were overcome were:

Grade separation of the bridge traffic from local streets.

Grade separation from lines of the three railways.

Separation of the various lines of bridge traffic without right angle turns on individual roadways to cover the following territory:

From the bridge to San Pablo Avenue, in Berkeley, thence downtown and crosstown into Oakland and to points south and east;

To Berkeley, El Cerrito, Richmond and points north.

Provision for traffic other than that to and from the bridge, as follows:

Crosstown and downtown Oakland to Berkeley, El Cerrito, Richmond and northerly;

Oakland waterfront to Berkeley, El Cerrito, Richmond and northerly and southerly.

COMPLEX STRUCTURE REQUIRED

Solving of these problems resulted in the interlaced and complex structure which attracts the attention of motorists at the East Bay approach to the bridge. In all, sixteen grade separations were necessary.

The distribution structure generally consists of 40-foot concrete deck spans supported on concrete piers with spread footings. About 2000 feet of the whole is of steel plate girder spans, the longest girder being 148 feet, with a span of 118 feet and a cantilever overhang of 28 feet. Nearly 200 piers support the structure, the floor system of which is structural steel with concrete decks reinforced by welded trusses.



Aerial view of intricate East Bay distribution structure showing how traffic problems were solved. The two roadways leaving the structure in the immediate foreground lead directly to the bridge approach.

The mole fill is from Pier E-39 to the distribution structure, roughly paralleling the Key Route interurban tracks. Construction was begun April 8, 1934. Material for the fill was taken from Oakland outer harbor north of the old ship channel. Material used ran an average of 75 per cent fine sand.

In addition to this work the Division of Highways had to build a double 9 by 9 foot concrete subway to allow passage to the waterfront of trucks of the factories in Emeryville, over whose property rights of way had to be obtained. This project cost $26,433.50.

Both the Oakland and San Francisco approaches were financed from a $6,600,000 appropriation voted by the legislature. This sum will be returned to the State gas tax fund from bridge tolls.

Teacher: "Where is the capital of the United States?"

"All over the world."

Fond Mother: "Well, son, what have you been doing all afternoon?"

Tough Youngster: "Shootin' craps."

Fond Mother: "That must stop. Those little things have as much right to live as you have."

American Canyon Cut-off Opened; Will Save Hour Between San Francisco and Capital

By R. E. PIERCE, District Engineer

THE SO-CALLED American Canyon Cut-off between Cordelia and the Carquinez Bridge —opened with formal ceremonies on November 10 arranged under the auspices of the State Chamber of Commerce is only one of several realignments that have been made in this important highway extending from San Francisco and the bay area to Sacramento.

The necessity of a more direct and faster road between Sacramento and San Francisco was realized shortly after the existing route was made a State Highway, and considerable thought was given to a direct road which would be away from the present road for almost its entire distance.

This idea, however, was given up in favor of improving the present road when it was found that the direct road was very little shorter than the proposed improvement of the present route. The investment in an entirely new route would be very large and would all have to be built before it could be used, while with the plan now in effect each unit can be built and put into use as funds permit.

The first unit to be constructed was the so-called Cordelia Cut-off, completed in 1929, extending from Route 8 which runs via the Jameson Canyon to and beyond Napa. This change, 1.2 miles in length, extending from a point a short distance west of the new junction with the American Canyon Cut-off, to old Route 7, northeast of Cordelia, eliminated a narrow, crooked, slow road through the town of Cordelia, and shortened the distance about 0.4 of a mile.

Originally this road was graded and bituminous surfaced, and in 1932 was paved with Portland cement concrete, as part of the same contract which built a new cut-off extending from the end of this first job to about one mile west of Fairfield. This new cut-off shortened the distance another three-fourths mile.

The next improvement, the so-called Orchard Line Change, southwest of Vacaville, was completed this year, eliminating the most tortuous piece of alignment on a major valley highway in the State. This cut off another three-fourths mile in distance and speeded up traffic.

The American Canyon relocation came next in time of completion, and as has been repeated a good many times, eliminates practically six miles of distance in addition to taking traffic off a considerable length of narrow, crooked streets in the city of Vallejo, and eliminates five grade crossings with railroads.

The latest project in the plan is the Vacaville By-Pass just getting under way. This unit, 2½ miles in length, starts at the east end of the Orchard Line Change and runs in a very direct alignment to the present road about ½ mile east of Vacaville.

This eliminates entirely the narrow, crooked, congested streets of Vacaville, and will be a great help in speeding up through traffic, as well as giving the local people more use of their streets with greater safety. This will shorten the distance another 0.1 mile.

The above listed projects show a total shortening in distance of 8 miles, between Sacramento and the Carquinez Bridge, which with the elimination of stretches of slow road should cut down the running time over the old route at least 25 minutes.

And this is not the end. Studies have been made of other possible changes, which if constructed, would cut off another six miles in distance and correspondingly shorten the driving time.

Changes in progress and proposed between the Carquinez Bridge and the Bay Bridge will also shorten the distance and cut the time, so that ultimately it should be an easy two-hour trip at the present speed limit between Sacramento and San Francisco.

Transcontinental Highways Lead to Bay Crossing

OF THREE transcontinental highways converging at Salt Lake City—U. S. 30, 40 and 50—two of them, U. S. 40 and 50, lead directly to the San Francisco-Oakland Bay Bridge.

These two highways join at Sacramento with U. S. 99 stretching from the State of Washington to Los Angeles, all feeding traffic onto the great bay bridge.

The opening of the new American Canyon Highway between Cordelia and Carquinez Bridge on November 10 cuts the driving time between Sacramento and San Francisco via the San Francisco-Oakland Bay Bridge about an hour and provides the motorist with a safer and faster highway than the old route via the Napa Y and Vallejo. It eliminates about six miles of distance in addition to taking traffic off a considerable length of narrow, crooked streets in Vallejo, and also eliminates five grade crossings with railroads.

Crossing the continent, motorists have a choice of two U. S. routes from Lake Tahoe to the bridge. They may follow U. S. 40 through such picturesque pioneer towns as Emigrant Gap, Colfax and Auburn to Sacramento, or they may go via U. S. 50 through the heart of the Mother Lode country to Stockton and thence to Oakland.

From Sacramento the motorist may travel either direct over U. S. 40 via the American Canyon cut-off to the bridge or over U. S. 50 through Stockton, California's great inland port.

Bill—Why does a person always lower his voice when asking for a loan?

Sam—I suppose for the same reason he raises it when he doesn't get it.



Sweeping view of new American Canyon cut-off between Cordelia and Carquinez Bridge which effects saving of about one hour's driving time to San Francisco from Sacramento City





Above is Cordelia underpass and on right, view of big fill on cut-off



Governor Frank F. Merriam cuts ribbon barrier. Left to right: J. R. Knowland, President State Chamber of Commerce; F. J. Grumm, Division of Highways; Senator Thomas McCormack; R. E. Pierce, District Highway Engineer; H. A. Hopkins, Chairman, Highway Commission; E. C. Crowley, Assemblyman; Senator F. L. Gordon; Gov. Merriam, Luther Gibson, E. J. Neron, Deputy Director Public Works; Earl Lee Kelly, Director Public Works; Supervisor John Keema, Sacramento; Congressman F. H. Buck; Supervisor Howard Knight, Marin; T. J. O'Hara, president Vallejo Chamber of Commerce. The little girl assistants are, left to right: Sarah Gaston of Vallejo; Jacqueline Boucher and Patsy Carmody of Sacramento and Jeannie Gibson of Vallejo

Program of Highway Officials Convention in San Francisco, Dec. 7-10

By W. C. Markham, Executive Secretary
American Association of State Highway Officials

WHEN THE ASSOCIATION held its Annual Convention in San Francisco twelve years ago, thirteen State Highway Departments did not answer to the roll call. The East had not yet learned to travel West; and had it been attempted "overland," it would have been an almost impossible task.

This year it is a different story and Maryland is the first to register from the Atlantic Seaboard. There will be 12 delegates. Don't think they are all taking streamlined trains or the "sky route," for some of them are planning to use your highways "all the way." Other Eastern States will have to look to their laurels.

It is not the purpose of this story to dilate upon the attractions of the city which knows full well how to be a gracious host, but to bring to you in short resume the outline of the program of important subjects provided by the Program Committee for the three days of the convention to be held in the Hotel St. Francis. This committee, which has provided the literary feast, is as follows: T. J. Pattison, Wisconsin, Chairman; H. A. Hopkins, California; H. D. Barnes, Kansas; H. E. Tabler, Maryland, and C. D. Snead, Bureau of Public Roads, Montgomery Alabama.

TWO GOVERNORS SPEAK

President Gilchrist will give the annual address and cover points he considers of vital import. Of course, this will follow an address by Governor Merriam of California.

Thos. H. MacDonald, Chief of the Bureau of Public Roads, has not been given a subject. He can be depended upon to put his finger on the proper electric button and show us something besides rules and regulations.

Wisconsin is one of the pioneers in building roads as a State, and was the first State to number the State highways as a convenience to the traveling public. Governor Philip La Follette of Wisconsin has been secured to give an oration on "The Financing of Public Works." Governor La Follette has shown keen interest in the value and need of public works and may be depended upon to take an advanced stand on this class of public responsibility, carrying an inspirational effect.



W. C. MARKHAM

Of course, one of the outstanding events for all highway officials will be the inspection and study of the great San Francisco-Oakland Bay Bridge, built under the direction of our general chairman, State Highway Engineer C. H. Purcell, chief engineer of the bridge. This structure will have been open one month at the time of our Convention.

Mr. C. E. Andrew, Bridge Engineer of the State Highway Department of California, will give the Convention an intimate and thorough description of this $77,000,000 project, together with many illustrations. All this before the Convention, in a body, drives over this monumental structure.

The Highway Departments are under everlasting obligations to the women of the states in helping to create the proper public opinion favorable to roadside beautification and development. In no State has greater work been accomplished along this line than in the State of Texas, and the Convention is fortunate in having Mrs. Frank W. Sorell of San Antonio, Texas, present an illustrated address on "Roadside Beautification and Treatment."

We hear much about highway safety and who is responsible for the greater number of accidents and deaths on the highways. This subject will be presented from three different angles to the Convention. Mr. R. E. Toms, Chief of Design of the Bureau of Public Roads, will discuss the subject from the standpoint of men whose responsibility is the design and construction of the highways. President Paul G. Hoffman of the Studebaker Corporation will submit argument from the angle of the construction of motor vehicles, and Mr. Sidney J. Williams of Chicago, representing the National Safety Council, will discuss the responsibility and control over the driver who uses the highways.

Nearly all of the states this year have begun a statewide highway and economic survey, more inclusive than any heretofore attempted. This work is being carried on by the State Highway Departments through cooperation with the U. S. Bureau of Public Roads, and Mr. H. S. Fairbank, who has charge of this work in behalf of the

(Continued on page 34)



Bridge Detail of Highway Patrol being inspected by (left to right) E. Raymond Cato, Chief of California Highway Patrol, District Inspector A. J. Ford, Captain Rudolph Schmoke and Captain A. Paquette.

Highway Patrol of 40 Men Detailed to Bridge

By RAY INGELS, Director of Motor Vehicles

ONCE again the California Highway Patrol rides into the picture in the interest of safety upon our highways. This time the highway is the magnificent San Francisco-Oakland Bay Bridge.

A Captain, three Sergeants and thirty-six men compose the permanent detail of patrol officers who are patrolling the Bay Bridge twenty-four hours a day. The Bridge Detail, as it is commonly known in the Patrol, is commanded by Captain Rudy Schmoke, an officer with many years experience, who came to the Bridge from the position of assistant in charge of the California Highway Patrol Training School.

He reports to District Inspector A. J. Ford of San Francisco in whose district the Bridge has been placed, who is, in turn, directly responsible, of course, to Chief E. Raymond Cato, of the California Highway Patrol.

In nearly every instance the men selected for the Bridge Detail were volunteers from various counties of the State, each an experienced officer.

The thirty-six traffic officers are divided into three shifts of twelve officers and a sergeant each. There is never a moment of the day or night that traffic on the bridge is not being controlled.

The headquarters of the Patrol is located in the Administration Building on the Toll Gate Plaza. There, every hour of the day and night will be found a sergeant and a traffic officer on duty.

The movements of the men on the Bridge are regulated from the Bridge Patrol Office. There are seven beats, extending from the Fifth Street Ramp in San Francisco to the Richmond City limits on the East Shore Highway. At the present time the East Shore Highway is open only to University Avenue in Berkeley.

The men are patrolling back and forth on these beats at all times, keeping traffic moving and endeavoring to prevent accidents in every way possible. They will not allow the motorist to "poke along" on the Bridge. In order to properly move the vast number of cars over the structure, it is necessary to keep traffic flowing as nearly as possible at a uniform speed. The speed limit, of course, is forty-five miles an hour.

No bicycles or pedestrians are allowed on the Bridge and no "U" turns are to be made. Also barred are vehicles carrying explosives, oil and gasoline trucks, tanks and trailers, and vehicles which, when loaded, exceed 102 inches in width; and, of course, animals may neither be led nor driven over the Bridge.

In addition to the seven riding beats, there are five stations located at strategic points on the bridge and approaches where an officer is on duty.

Camarillo State Hospital for 6000 Mental Patients Opened

By GEORGE B. McDOUGALL
State Architect

THE new Camarillo State Hospital was dedicated and formally opened by Governor Merriam with an appropriate ceremony on October 12, 1936, at 2 o'clock p.m.

The dedication was attended by between 1000 and 1200 people.

The arrangements for the ceremony were made by the Ventura County Chamber of Commerce. The president of the chamber, Mr. W. H. Glover, opened the exercises with words of welcome. Mr. Louis C. Drapeau, State Building and Loan Commissioner, spoke for the people of Ventura County, making particular reference to their appreciation of the action of the State in locating the institution in their county.

Music was furnished by a Spanish orchestra from Santa Barbara and Miss Harriet H. Hegstad, teacher of music at the Ventura School for Girls, sang the Star Spangled Banner. Mr. Drapeau introduced Mr. Harry Lutgens, State Director of Institutions, who presided over the remainder of the exercises.

PROMINENT CITIZENS INTRODUCED

Mr. Lutgens introduced numerous prominent citizens including Mr. Adolfo Camarillo, large land holder and long time resident of Ventura County in whose honor the new institution is named, also the heads of numerous State institutions and State and county officials.

Following these introductions Director Lutgens described in an interesting and very informing address the Department of Institutions and its thirteen different units but with special reference to the seven State Mental Hospitals of which the new Camarillo State Hospital is one.

At the conclusion of his address Mr. Lutgens introduced the writer, who described the buildings so far erected, also the proposed future construction.

Mayor Frank L. Shaw of the City of Los Angeles was unable to be present but was represented by Dr. George Parrish of the Los Angeles Health Department whose address was in congratulation on the opening of the new institution. The Medical Superintendent of the new hospital, Dr. Thomas W. Hagerty, was introduced and delivered an address outlining some of the functions of the institution and indicating his earnest hope and expectation that these functions would be fully performed.

GOVERNOR UNVEILS PLAQUE

Governor Merriam in his dedicatory address which was delivered in the Governor's characteristic happy and effective fashion, declared "the Camarillo State Hospital is destined to be the greatest of its kind in California."

At the conclusion of his address the Governor with the assistance of Director Lutgens dedicated the new institution by unveiling a bronze plaque which is to remain permanently on the wall at the main entrance to the administration offices and which contains the following inscription:

"CAMARILLO STATE HOSPITAL
FRANK F. MERRIAM
GOVERNOR OF CALIFORNIA
HARRY LUTGENS
DIRECTOR OF INSTITUTIONS
THOS. W. HAGERTY
MEDICAL DIRECTOR
GEO. B. McDOUGALL
STATE ARCHITECT
DEDICATED OCTOBER 12, 1936."

At the close of the exercises all those desiring to do so, looked through the new buildings.

LOCATED NEAR OCEAN

The Camarillo State Hospital is located on a site containing about 1700 acres of which about 1100 acres are tillable. The site is situated about two miles from the town of Camarillo, eight miles south of the city of Oxnard, seventeen miles south of the city of Ventura and about fifty-six miles north of the city of Los Angeles. It lies about five miles in a direct line from the Pacific Ocean. The climate is the typical California coastal climate, equable and delightful.

After several months of examination, investigation and careful consideration of more than two hundred suggested sites by the official site commission assisted by representatives of the various divisions of the State Department of Public Works and the University of California, the location near Camarillo was selected and is undoubtedly the best site for a mental hospital which the State has.

Following the selection of the site, representatives of the Department of Institutions and the State Architect spent a month visiting and carefully examining most of the larger mental hospitals in the states of Illinois, Massachusetts, New Jersey, Pennsylvania and New York.

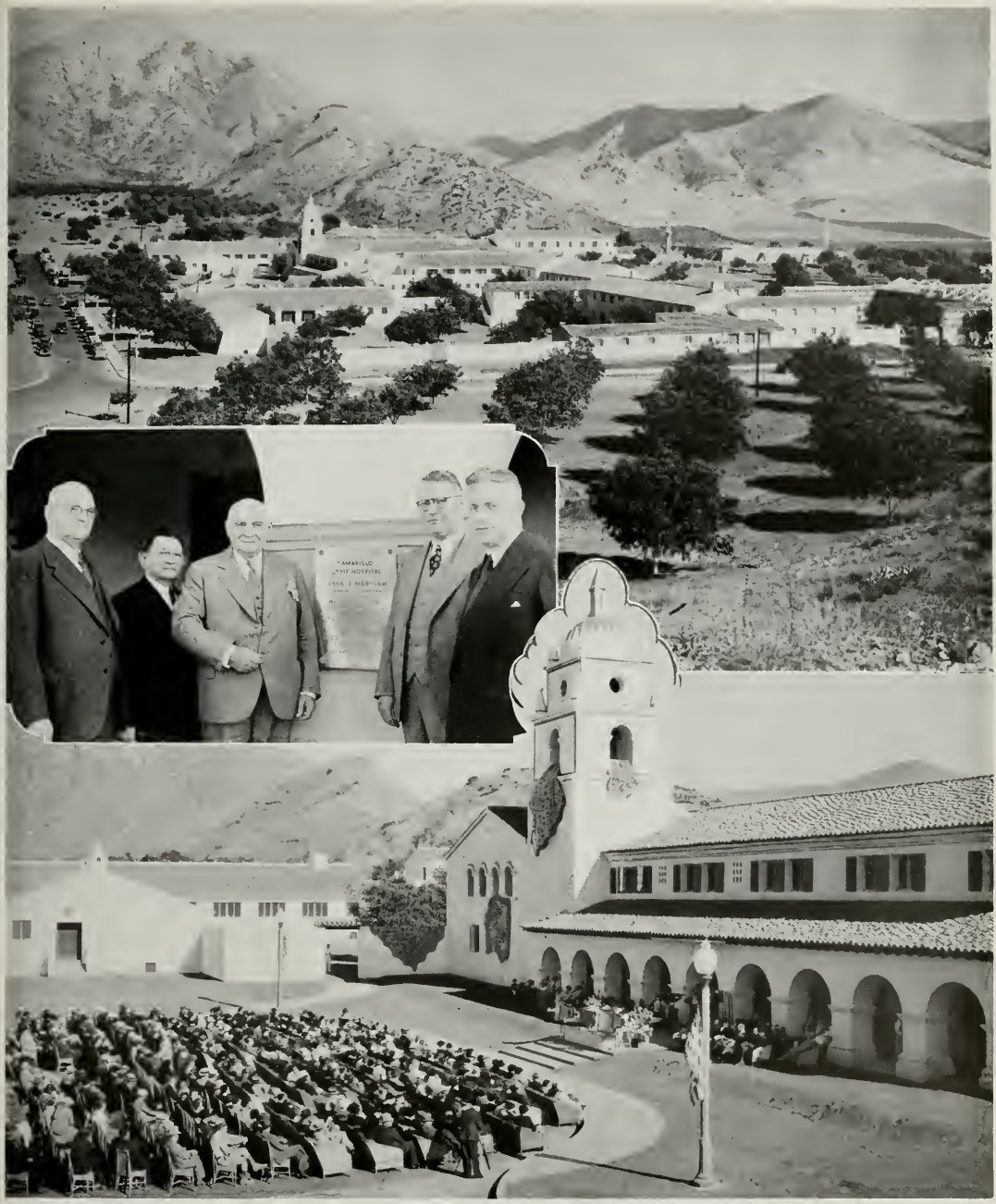
6000 ULTIMATE CAPACITY

The Division of Architecture of the State Department of Public Works then developed a master plan for an ultimate institution to accommodate six thousand patients and the necessary one thousand employees. This master plan is being followed in the construction program subject to minor changes which appear desirable as the detailed development proceeds.

In the planning process the Division of Architecture had and continues to have the expert medical advice of a committee composed of Dr. G. M. Webster, Medical Superintendent of the Patton State Hospital, Dr. Edwin Wayte, Medical Superintendent of the Norwalk State Hospital, and, since his appointment early this year, Dr. Thomas W. Hagerty, Medical Superintendent of the Camarillo State Hospital.

There are to be three main housing groups in the entire institution, the group for custodial males with a capacity for 2400, the group for custodial females with a capacity for about 2200 and the group which will include the treatment or hospital unit and receiving units also the units for acute disturbed patients, for infirm patients and for tuberculosis patients, a total in this third group of about 1500.

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Scenes at dedication of new Camarillo State Hospital. Upper—Some of buildings and grounds of institution. Center (left to right)—State Architect George B. McDougall, Adolfo Camarillo, Governor Frank F. Merriam, Dr. Thomas W. Hagerty, Medical Superintendent; Harry Lutgens, Director of Institutions. Lower—Entrance court of administration unit where dedication ceremonies were held.

Program of Highway Officials Convention

(Continued from page 30)

bureau, will discuss this important subject before an open session of the Convention.

MOUNTAIN ROAD CONSTRUCTION

"Interesting and Unusual Mountain Road Construction" is of itself attractive to all delegates of this Association. The Western Group of engineers are especially experienced along this line and their experience and observations will be pictorially exemplified by Mr. L. V. Murrow, Director of Highways in Washington.

Everybody knows there is no one in the country more fully informed on highway research problems than Mr. H. S. Mattimore, Engineer of Tests in Pennsylvania, who for many years has been Chairman of the Committee on Materials of this Association. Mr. Mattimore will bring to the Convention some observations on the most recent developments in highway research.

The space allotted us to give a short outline of the program has been exhausted and we haven't even mentioned the group meetings of fourteen very important groups of the Association, who will handle important subjects in their studies on both Tuesday and Wednesday of the Convention week.

The program in detail is as follows:

MONDAY, DECEMBER 7, 1936

MORNING

General Session

GIBB GILCHRIST, Texas, President, Presiding

8:30—Registration of Members and Official Visitors.

10:30—Prayer: Rt. Reverend Monsignor John W. Brockhage, Pastor, Holy Cross Church, San Francisco.

Address of Welcome by Governor Frank F. Merriam.

Response and President's Annual Address by Gibb Gilchrist, State Highway Engineer, Texas.

Address by Earl Lee Kelly, Director of Public Works, California.

Presentation of Testimonial to Past President A. W. Brandt, New York, by F. E. Everett, State Highway Commissioner, New Hampshire.

Memorial Service.

Annual Report of W. C. Markham, Executive Secretary.

Roll Call by States.

AFTERNOON

General Session

W. F. CALLAHAN, Massachusetts, Vice President, Presiding

2:30—Address: Thomas H. MacDonald, Chief, Bureau of Public Roads, United States Department of Agriculture, Washington, D. C.

Introduction of Official Visitors from Canada and Mexico.

EVENING

7:00—Buffet Supper on San Francisco Bay as guests of the State Highway Department of California. Tickets will be issued to delegates and members of their families, who are cordially invited.

TUESDAY, DECEMBER 8, 1936

MORNING

General Session

JAMES D. ADAMS, Indiana, Vice President, Presiding

9:00—Address: "San Francisco-Oakland Bay Bridge," C. E. Andrew, Bridge Engineer, California Highway Department.

Address: "Roadside Beautification and Treatment," Mrs. Frank W. Sorell, San Antonio, Texas.

Group Meetings

NOTE: Group meetings begin at once, according to room assignments in the St. Francis Hotel, indicated in this program. *In addition to topics listed, which will be open for general discussion, other topics may be taken up if desired.* All delegates are cordially invited to attend the meetings of their choice and participate in the discussions. These meetings will be presided over by Chairman of regular Standing Committees.

Conclusions concerning the discussions held are reserved for the Executive Sessions of the various Standing Committees which meet Wednesday morning.

ADMINISTRATIVE PROBLEMS—Room 220
H. A. HOPKINS, California, Presiding

LEGAL AFFAIRS—Room 278
CHARLES ROSS, South Carolina, Presiding

TRAFFIC CONTROL AND SAFETY—Room 266
W. F. ROSENWALD, Minnesota, Presiding

UNIFORM ACCOUNTING—Room 270
H. D. BARNES, Kansas, Presiding

PUBLIC RELATIONS AND PUBLICITY—Room 274
J. D. ADAMS, Indiana, Presiding

BRIDGES AND STRUCTURES—Room 214
A. L. GEMENY, Bureau of Public Roads, Presiding

Some Problems of General Interest to Bridge Engineers in Connection with the Construction of the Trans-Bay Bridge at San Francisco. Discussion by C. E. Andrew, California.

Working Unit Stresses for Concrete Bridge Design in Their Relation to the Physical Properties of the Concrete and Steel. Discussion opened by G. S. Paxson, Oregon.

The Esthetics and Design of Handrails and Curbs for Highway Bridges. Discussion opened by Morris Goodkind, New Jersey.

The Present Limitations on the Use of Welding in Steel Bridge Construction. Discussion opened by O. J. Eidmann, Kansas.

MATERIALS AND RESEARCH—Room 270
H. S. MATTIMORE, Pennsylvania, Presiding

ROAD DESIGN—Room 280
O. L. KIPP, Minnesota, Presiding

ROAD CONSTRUCTION—Room 261
E. C. LAWTON, New York, Presiding

MAINTENANCE—Room 221
R. H. BALDOCK, Oregon, Presiding

ROADSIDE PLANTING AND DEVELOPMENT—Room 268
JOHN L. WRIGHT, Connecticut, Presiding

Means of Reducing the Maintenance Costs of Improved Roadside Areas. (General and main topic.)

AFTERNOON

General Session

GASTON SCOTT, Alabama, Vice President, Presiding

2:00—Address: "The Financing of Public Works," Honorable Philip F. La Follette, Governor of the State of Wisconsin.

Address: "State-wide Highway Planning Surveys," H. S. Fairbank, Chief, Division of Information, U. S. Bureau of Public Roads, Washington, D. C.

Group Meetings

The Group Meetings will be a continuation of the morning session, with the same meeting places and the same presiding officers. All delegates are urged to attend and take part in the discussions.

EVENING

No session. The evening is left open at the pleasure of the delegates.

WEDNESDAY, DECEMBER 9, 1936

MORNING

General Session

L. V. MURROW, Washington, Vice President, Presiding

9:30—Address: Highway Safety Exemplified:

(a) By Properly Designed and Constructed Highways. R. E. Toms, Chief, Division of Design, U. S. Bureau of Public Roads, Washington, D. C.

(b) By the Construction and Supervision of the Motor Vehicles Which Use the Highways. Paul G. Hoffman, President, Studebaker Corporation, South Bend.

(Continued on page 36)



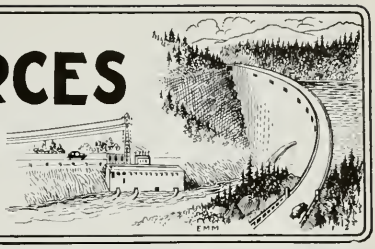
DIVISION OF WATER RESOURCES

OFFICIAL REPORT

FOR THE MONTH OF

October, 1936

EDWARD HYATT, State Engineer



Construction work on the cooperative State-Federal bank protection program providing for permanent bank protection on the Sacramento River is progressing rapidly. Work on the program was started on October 1st by the United States War Department and to date projects have been approved for construction which it is estimated will cost approximately $200,000.

This bank protection program is being carried out by the United States War Department in cooperation with the Division of Water Resources. Due to the lateness of the season it was not possible to permit the work being let by contract and therefore it is being done by day labor with Government equipment.

There are at present employed about 150 men, the equipment consisting of 6 drag line machines, 2 clam shell dredgers, 2 bulldozers, 3 tow boats, 12 barges, 2 floating pile drivers, 5 quarter boats, 10 dump trucks, 5 flat rack trucks, a number of small express trucks and several automobiles.

IRRIGATION DISTRICTS

Following approval by the Districts Securities Commission, the Pacheco Pass Water District held a second election on September 25, at which a bond issue in the amount of $180,000 was voted for constructing a storage dam and irrigation works on Pacheco Creek. The district comprises an area of 5395 acres in San Benito and Santa Clara counties.

South Fork Irrigation District in Modoc County has completed construction of West Valley Dam on a tributary of South Fork of Pit River. The reservoir created will provide storage for irrigation of 12,400 acres within the district.

At the regular monthly meeting of the Districts Securities Commission held in San Francisco, October 9, favorable action was taken on the following district petitions: Fairoaks Irrigation District's request for an expenditure of $4,600 from the general fund for a pipe replacement project in cooperation with WPA was granted. West Side Irrigation District was permitted to waive the statute of limitations on certain outstanding warrants. Grenada Irrigation District's proposal to expend $1,800 for purchase and installation of wood stave pipe on its main pumping lift was approved.

FLOOD CONTROL AND RECLAMATION

Relief Labor Work

During this period a relief labor crew of about 20 men has been engaged in clearing in the flood channels of the Feather River north of Marysville and in the Butte Slough By-pass.

Two WPA projects have been approved, as follows:

WPA Project No 165-3-5504, approved October 1, 1936, for clearing and removing obstructions in the American River flood channel; Federal funds, $13,648.

WPA Project No. 165-03-5014, approved September 15, 1936, for Feather River clearing; Federal funds, $22,646.

From present indications the amount of relief labor to be made available on flood control this winter will be very considerably less than was employed last winter. This is brought about partly by the fact that the demand for labor in private employment is substantially increased, and partly because the number of men to be placed on relief will be limited by definite county quotas. We expect to have available approximately one-third of the number of men that were employed last winter.

Bank Protection Program

The U. S. War Department is progressing rapidly on the construction of bank protection works under the State-Federal cooperative program. This work commenced actively on October 1st, and projects at particular sites have been approved which will cost approximately $200,000.

Two projects have already been completed. On the left bank of the Sacramento River immediately north of the Colusa weir, the bank has been protected for a distance of 800 feet with selected cobble pavement on the bank and a woven lumber mat below the low water line. On the right bank of the Sacramento River at Hamilton Bend, about four miles above Colusa, similar protection has been constructed for a length of 820 feet, except that quarry rock has been used for bank paving instead of cobbles. Work is now under way and almost completed at the Campbell-Dwyer ranch, three miles below Colusa on the right bank of the Sacramento River, where rock paving and timber mat bank protection is being installed for a length of 2400 feet. A second plant is now working on the right bank of the Sacramento River below Sacramento at the Alaska Packers Association headquarters in Reclamation District No. 900. At this place a woven lumber mat will be installed and the bank paved with rock for a distance of 1400 feet. This work will be completed shortly after which the plant will be moved for work near the Standard Oil dock near Walnut Grove.

CALIFORNIA COOPERATIVE SNOW SURVEYS

With snow in the mountains due at any time, arrangements have been completed for the continuation next winter of all snow surveys regularly made by the many cooperating agencies.

The organization that formerly made the snow measurements in the Mono and Bishop Creek basins is this year discontinuing its snow survey work and new arrangements have been made for the continuation, in these areas, of several of the crest course surveys, desired for forecasts of run-off of the San Joaquin and Kings rivers on the west side. Yosemite Park rangers will survey the snow courses at Tioga Pass and Dana Meadows, while the Forest Service, through its rangers of the Inyo National Forest, will take over the courses at Bishop and Pinte passes with the crest course at Agnew Pass to be surveyed by rangers of the Mono National Forest.

On the divide between the Cosumnes and Mokelumne rivers, four new courses have been established during the past month at the following locations: Tragedy Springs, Corral Flat, Lumberyard Ranger Station, and Hams Station. The annual surveys at these new courses will be made by rangers of the Eldorado National Forest.

CENTRAL VALLEY PROJECT

The United States Bureau of Reclamation continued work during the month on the preparation of plans necessary for starting construction on the initial units of the project. Preliminary investigations and exploration work have been continued at Kennett and Friant dam sites as have the surveys along the Contra Costa Conduit and Friant-Kern Canal. Appraisers are working in the field evaluating lands and necessary rights of way to be acquired.

Highway Convention Program

(Continued from page 34)

(c) By Responsibility of and Control Over the Driver on the Highways. Sidney J. Williams, Director, Public Safety Division, National Safety Council, Chicago.

MEETINGS OF STANDING COMMITTEES

Immediately following the addresses, there will be Executive Sessions of Standing Committees in rooms indicated under list of Committees, as follows:

WEDNESDAY, DECEMBER 9, 1936

AFTERNOON

Trip to San Francisco-Oakland Bay Bridge.

EVENING

7:00—The Members of the Association will be dinner guests of the California State Highway Department at the St. Francis Hotel.

THURSDAY, DECEMBER 10, 1936

MORNING

General Session

GIBB GILCHRIST, Texas, President, Presiding

9:00—Address: "Interesting and Unusual Mountain Road Construction," L. V. Murrow, Washington, Director of Highways.

Address: "The Most Recent Developments in Highway Research," H. S. Mattimore, Pennsylvania, Engineer of Tests.

Business Session—Committee Reports

GIBB GILCHRIST, President, Presiding

AFTERNOON

Business Session—Continued

Installation of Officers.

Adjournment.

EVENING

7:00—Film, "California Highways."

9:00—Chinatown Pageant.

FRIDAY AND SATURDAY, DECEMBER 11 AND 12

Through the courtesy of the California State Highway Department, two caravan trips are offered to the members of the Association, as follows:

1. Starting Friday morning, transportation will be furnished delegates to Los Angeles taking Friday and Saturday for the trip, going via Big Trees, Del Monte, and Santa Barbara. Delegates taking this trip will be expected to pay all expenses except transportation.

2. A caravan limited to 60 people, all expenses paid, over the North Redwood Highway. This trip is especially advantageous for those returning via Portland and Grant's Pass, Oregon. Parties desiring to return to San Francisco or Sacramento will be taken there.

Full particulars in reference to these two trips will be given by the California State Highway Department.

CAMARILLO HOSPITAL OPENED

(Continued from page 32)

One underlying principle of the plan is that it makes the out-of-doors as easily accessible to all the patients as possible at the same time making it practicable to classify the patients into a considerable number of different groups which can be kept separate from one another. The patients' buildings are one and two stories high, two-thirds of the patients being in the first stories and one-third in second stories.

There will be a separate kitchen and dining room unit in each of the three groups. Each of the three groups has all its units connected and under roof. This makes the structures of a group more compact than they would be if separated and also provides access under roof for all patients and employees to the various parts of the group including the dining rooms.

In the matter of separation of the patients into groups for purposes of classification the various wards are independent of each other. In the group for custodial males there are twelve different enclosed courts, the plan being so arranged that two and in a few cases three wards have separate access to each court.

LARGE CENTER COURT

In addition to the twelve smaller separate courts just described, there will be a large center court surrounded on four sides by the structures of the group. This center court has an area of 6½ acres and will be available for mass recreation of the patients. It will be properly landscaped and have areas developed for various games, band stand, etc. A similar arrangement as to courts will be provided in the group for custodial females. In the third or medical group there will be the smaller courts only.

The treatment and receiving units will have a total capacity for 500 patients.

Provision is being made for housing on the grounds about one-third of the employed personnel the remainder to live elsewhere in the neighborhood of the institution.

A dairy to have an ultimate capacity for milking 425 cows daily is being constructed.

There are laundry, bakery, cold storage, commissary and shop units.

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official journal of the Division of Highways of the Department of Public Works, State of California; published for the information of the members of the department and the citizens of California.

Editors of newspapers and others are privileged to use matter contained herein. Cuts will be gladly loaned upon request.

EARL LEE KELLY.....Director
JOHN W. HOWE.....Editor

Address communications to California Highways and Public Works, P. O. Box 1499, Sacramento, California.

Vol. 14 NOVEMBER, 1936 No. 11

There will be a poultry plant ultimately to care for approximately 10,000 birds and provision for carrying approximately 600 hogs.

All services are provided including a most modern sewage treatment plant the effluent from which will be used for irrigation, a steam plant, water service, gas and electric service, flood control system, roads, walks and landscaping.

The buildings are entirely of reinforced concrete, fire, earthquake and deterioration resisting to the highest practicable degree. The style of architecture is the California adaptation of the Mediterranean styles of Spain and Italy. The whole institution in plan and design takes into account the fact that the right physical surroundings have definite therapeutic value and so supplement the efforts of the Medical Superintendent and all his helpers in their work in the best interests of the State's wards committed to their care.

The institution is not only destined to be the greatest of its kind in California, as Governor Merriam said in his dedicatory address, but it is entirely safe to say there is no other such institution for the mentally ill in the entire country.

There is at present provision for 1100 patients and structures now under way will add capacity for 1400 more. So far there has been appropriated for all purposes in the construction of the institution including the cost of the site about $3,600,000 and the ultimate institution will probably involve a further expenditure of $5,500,000 more or a total of about $9,000,000.

STATE OF CALIFORNIA

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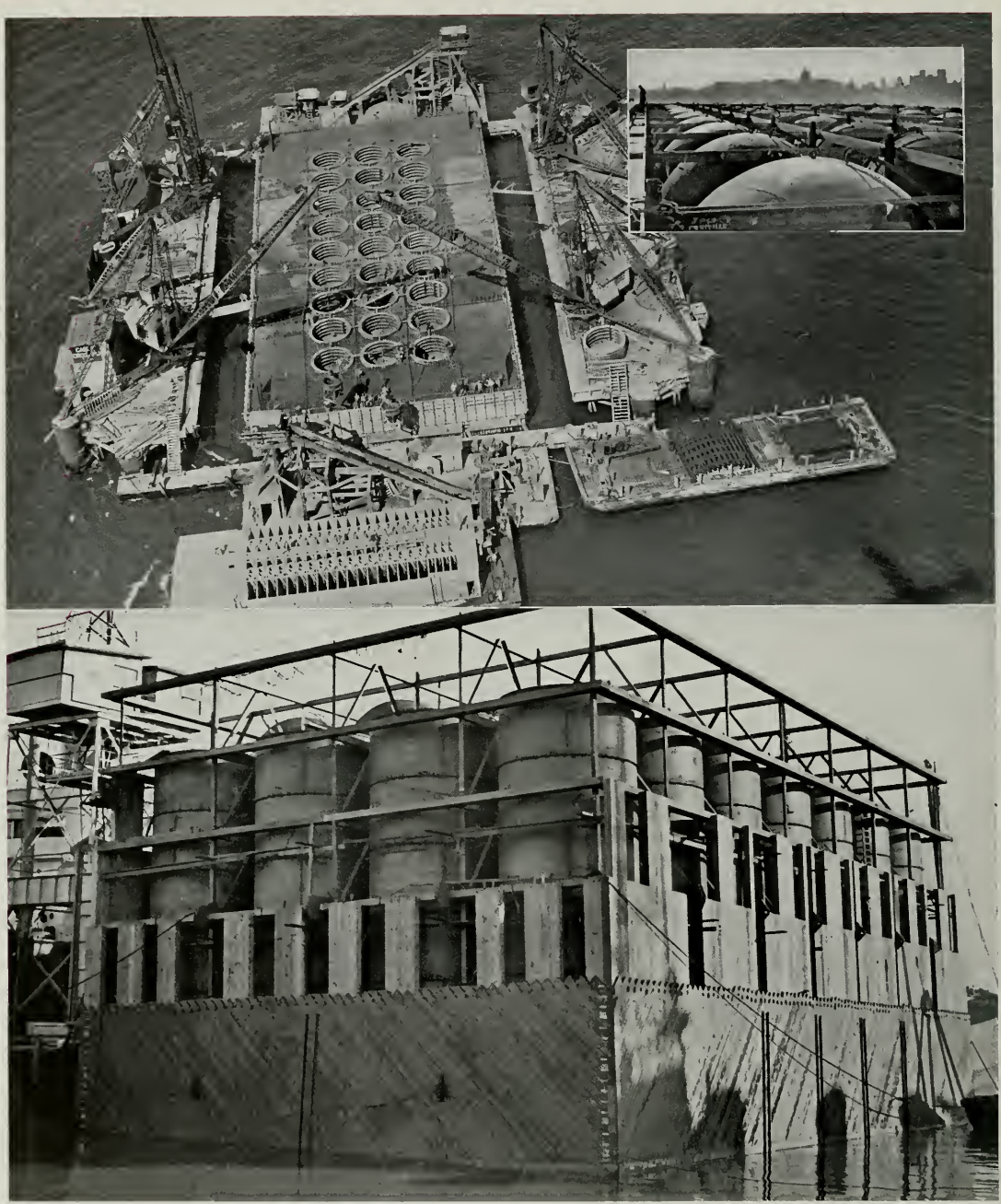
CALIFORNIA

HIGHWAYS AND PUBLIC WORKS

A.A.S.H.O. Convention Number

December 1936

Official Journal of the Department of Public Works



Views of flotation cylinder caissons used for the first time in bridge construction to build foundations for towers and central anchorage of San Francisco-Oakland Bay Bridge, which were shown on screen to delegates to convention of American Association of State Highway Officials by C. E. Andrew, Bridge Engineer. Upper—Showing how one caisson looked before pouring of concrete into steel tubes for sealing was completed. Inset—Air-tight domes on tubes through which air was pumped into cylinders, displacing the water, to make each cylinder act as air buoy until bottom of caisson rested upon rock. Lower—View of caisson from water level during sinking of cylinders.

Forty-four States Send 897 Representatives to Highway Convention in San Francisco

WITH only four of the forty-eight states of the Union missing on the roll call of delegates, the American Association of State Highway Officials held the largest and most important convention of its twenty-two years of existence in San Francisco December 7-10.

A total of 897 delegates, their ladies and guests from all parts of the Nation including Hawaii, participated in the sessions, representing a 115 per cent larger attendance than at any previous national meeting of State highway officials. Maine, New Jersey, Montana and West Virginia were the only absentees.

Men of outstanding prominence in road building emphasized in their addresses the imperative need for increased highway safety, higher standards of road construction by systematic rehabilitation of existing routes and improved new construction, greater cooperation with the Federal Government in the expenditure of government highway fund allocations, a determined stand against movements to reduce gasoline taxes and an unremitting campaign of education to prevent diversion of gas taxes to purposes other than highway building, maintenance and administration.

ATTENDANCE RECORD BROKEN

Not only was the convention remarkable for its new attendance record and the importance of its deliberations and accomplishments, but, on the word of its high officials, men who have attended many annual gatherings of the association, the entertainment provided for the delegates, their wives and members of their families by the California Division of Highways far surpassed anything in that line heretofore undertaken.

For four days, until adjournment on Thursday afternoon following the election of new officers, the delegates were kept almost continuously busy with convention duties and pleasures arranged for them while their ladies were equally busy taking sightseeing trips on land and in the air, attending luncheons and other gay affairs.

Resolution No. 1

Adopted at Convention of American Association of State Highway Officials

WHEREAS, This Association, at their Annual Meeting held in Miami, Florida, one year ago, passed a resolution requesting the Congress to continue the allotment of regular Federal Aid for at least a two-year period; and

WHEREAS, The Congress at its following session did pass such legislation and has made regular Federal Aid available to the States for each of the fiscal years of 1938 and 1939;

NOW THEREFORE, BE IT RESOLVED, That the American Association of State Highway Officials, assembled in convention at San Francisco, California, December 10, 1936, express their appreciation to the Congress of the United States for its action, and pledge their sincere and earnest support in carrying out that part of this program which is entrusted to them.

The new president of the American Association of State Highway Officials elected by the convention is T. H. Cutler of Kentucky, succeeding Gibb Gilchrist of Texas.

Other officers and new members of the Executive Committee elected are:

Vice Presidents: First District, John V. Keily, Rhode Island; Second District, R. A. Harris, Mississippi; Third District, Ernest Lieberman, Illinois; Fourth District, James B. True, Wyoming.

Treasurer: W. W. Mack, Delaware (reelected).

Executive Committee: F. R. White, Iowa (term expires 1941); Frederic E. Everett, New Hampshire (term expires 1941); Arthur W. Brandt, New York (term expires 1940).

BIDS FROM SEVEN CITIES

The Executive Committee will meet next June at a place to be selected to pick the next convention city. At the San Francisco meeting Boston, New York, St. Louis, Columbus, O., Cincinnati, Hot Springs, Ark., and French Lake, Ind., all made bids for the next convention.

Practically all of the delegates were present in San Francisco by the afternoon of Sunday, December 6, and the evening of that day was given over to informal receptions for the visitors and their wives, under the auspices of officials of the Department of Public Works.

With Gibb Gilchrist of Texas, president of the association, presiding, the first general session of the convention was called to order in the Colonial ballroom of the St. Francis Hotel at 10.30 Monday morning.

WELCOMED BY DIRECTOR KELLY

As Director of the California Department of Public Works and the representative of Governor Frank F. Merriam, Earl Lee Kelly welcomed the delegates.

"On behalf of the Governor of our State, His Excellency, Frank F. Merriam, the official family of our Division of Highways and the millions of our friendly citizens, I welcome you to California, the land of romance and the place where golden dreams come true," said Director Kelly.

"Today we bring you greetings from our State with its more than six million people which but ninety years ago was just beginning to be populated by the pioneers of the gold-rush days. In these ninety years we have developed a mighty empire teeming with mineral, agricultural, industrial, commercial and recreational activity.

FROM TRAILS TO HIGHWAYS

"All of the great natural wonders of our State in the pioneer days were linked together only by the winding trail of the padres, which has given way in this short space of time to our magnificent bridges and to more than twenty thousand miles of beautiful paved highways in California.

"I am proud to stand before you today. I deem it a privilege to welcome you to this land of romance and of opportunity, and to this city by the Golden Gate. I hope that your visit will not only be of a constructive nature but that it will be one of happiness and pleasure to you, so that when you have returned to your homes you will look back on this occasion with remembrances of a friendly and hospitable people. May I express the wish that you will all soon come back again."

Urging the visitors to take advantages of arrangements made for them to cross the San Francisco-Oakland Bay Bridge, now a part of the California Highway System, Director Kelly paid a high tribute to State Highway Engineer C. H. Purcell and his staff who "conceived and built the magnificent structure spanning San Francisco Bay."

MAYOR ROSSI REPRESENTED

Owing to the fact that he was confined to his home by illness, Mayor Angelo J. Rossi of San Francisco was unable to be present to extend a welcome. He was represented by Alfred J. Cleary, chief administrative officer, who warmly invited all the delegates and members of their families to make free of the city and San Francisco's famed hospitality.

President Gilchrist, who is State Engineer of Texas, responded to the welcoming speeches and then launched into the delivery of his annual address. He won the undivided attention of the delegates.

Mr. Gilchrist said that stabilization of the business of building highways was one of the major accomplishments of 1936. Highlights of his talk were discussions of long range road planning, the growing problem of improvement of secondary highways, the need for increased safety on highways, diversion of gasoline tax funds to other than highway uses and the value of roadside beautification.

SOLD ON FEDERAL AID

"The best opportunity for long range planning ever offered became the lot of the States in 1936, the speaker declared. The advantages of long range appropriations are too many to enumerate. More time is given to location; more time is given prospective bidders to examine proposed work, with the result that bids will be submitted with less hazard and more time given to construct where such time is needed.

"The States are ready for this kind of thing and the entire country is sold on the principle of regular Federal Aid. If I were giving advice to highway officials it would be to plan construction programs not less than four years ahead and carry general layouts much further."

Resolution No. 2

Work Relief Funds

WHEREAS, it has been demonstrated that Highway Construction has been extremely efficient in providing employment during times of need; and

WHEREAS, Permanent public improvements have been obtained from such work;

NOW THEREFORE, BE IT RESOLVED, That the American Association of State Highway Officials, assembled in convention at San Francisco, California, December 10, 1936, requests the President and Congress of the United States, in the event that appropriations are made for work relief, to make available for highway construction a substantial portion of this appropriation; that this be made available through the Bureau of Public Roads to the Highway Departments; and this Association through the highway departments pledges its sincere and earnest cooperation in the expenditure of any funds alloted for this purpose.

On the subject of Federal Aid, Mr. Gilchrist said:

"The appropriation of $25,000,000 during each of the years 1938 and 1939 for secondary or feeder roads has met with popular approval and possibly will be made permanent. It will be necessary for the States to give increasing attention to this phase of the road building industry.

"One matter on which there seems to be a preponderance of opinion is that the work should be handled through the United States Bureau of Public Roads by the respective highway departments in the same manner as regular Federal Aid. This should apply whether county or road district money is used to defray a part of the cost." *

TESTIMONIAL TO A. W. BRANDT

Following the address of the president, F. E. Everett, State Highway Commissioner of New Hampshire, formally presented a testimonal to Past President A. W. Brandt of New York and in doing so reviewed Captain Brandt's war record and his achievements as head of the American Association of State Highway Officials.

Brief memorial services for departed members were held and then W. C. Markham, the veteran executive secretary of the association, made his annual report. Mr. Markham predicted that 1937 will be a banner year in highway construction. He said:

"Records of State highway departments show that mileages of improved roads will be greatly increased and so, naturally, that will mean increased expenditures during 1936, soon to close. We will close this year with virtually all of the regular and special Federal funds absorbed in contracts and will enter the coming year prepared to carry on a building program, involving construction only, of not less than $400,000,000.

585,000 SURFACED MILES

"Everybody knows that the motor fees and gas tax paid by the people have been transferred into roadbeds, bridges and elimination of railroad crossings. In 1923 there were 80,209 miles of surfaced roads of all kinds in the United States. Today there are about 400,000 surfaced miles on the State systems alone, and over 585,000 surfaced miles on county and township roads.

* Mr. Gilchrist's address appears on page 22 of this issue.

(Continued on page 19)

$800,000,000 Available Next Year if States Match Federal Aid Quotas

By THOS. H. MacDONALD, Chief, U. S. Bureau of Public Roads

TO DRIVE a modern motor car a quarter of a century measured by traffic conditions, into the past, is an illuminating and valuable experience. In a public enterprise such as ours—the building of a system of universal highways for a nation—the test of time is all important. It measures the adequacy of the vision into the future, and the competency of the means adopted to meet the imagined requirements.

My recent opportunity to study traffic conditions in many of the countries of the old world clarified many uncertainties, and indicated the very definite directions that Federal and State highway policies of the future should take. A vivid panorama passed in review, with all the variations from the streets of London where motor traffic is congested to the point of near stoppage, to the roads of Jugoslavia where the motor vehicle is yet so novel that the horses in common use are frightened and frequently behave badly, as was true in this country more than a quarter of a century since.

LONDON ROAD EXAMPLE

Doubtless selected examples rather than generalities from these other countries present the best means of conveying the valuable information that we may gain. Especially is this true because of the long-time aspects which alone determine the inherent soundness of the policies which give form to the undertakings.

Some eight years ago I inspected the newly completed Great West Road leading out of London. The construction had been undertaken for the purpose of providing employment, but its conception was to provide a wide thoroughfare of large traffic capacity to permit uninterrupted flow between the heart of London and the suburban and rural districts to the west. The roadway was paved at least 50 feet wide, and designed to carry heavy units.



THOS. H. MacDONALD

At that time a considerable part of its length was bordered by open fields. Today it is lined by continuous large industrial enterprises of many kinds. Traffic conditions are as congested as on the roads previously existing which this new highway was expected to relieve. It has lost its visioned function to move traffic expeditiously over a considerable distance, and has become a crowded, local service road.

If this actuality is projected against the by-pass designs which are in common use here, there is no essential difference in either the conception of their purpose or their design. The experience in this case leads directly to the conclusion that where the population is sufficient to make desirable by-pass or radial distance routes, population and industries will gravitate rapidly and certainly to the new highways.

Because of the better traffic facilities offered, new enterprises will come into existence, and within a surprisingly short time we have only another city street with congested traffic. It soon loses its ability to serve the original purpose.

TRAFFIC SEPARATION ESSENTIAL

Other examples might be given, but the trend everywhere is so clearly defined, the conclusion is inescapable that to serve as by-pass or through distance routes, the design must carry on separate roadways the through and the local traffic, and the local traffic must be so adequately served that it will only be necessary to give access to the through highways at infrequent intervals.

France presents the opportunity to observe major projects undertaken for the relief of street and highway congestion in the metropolitan area of Paris. Here we get the conception of the dynamic instability of the great population centers when new transportation facilities become available.

Perhaps we have accepted the changing aspects of our own cities with the thought that these are characteristic of all youthful growth, but Paris is an old world city, itself ancient in comparison to any of our own. Nor is it a city that grew without direction. No single plan was adopted and adhered to through the years, but rather a series of progressive conceptions have been superimposed, each in harmony with those preceding.

ANCIENT PARIS STRUCTURES

Because of the lack of apparent change in recent years, Paris had taken on an unchanging atmosphere, neither old nor young, but of no period of time. Highways and

bridges of the time of Louis XIV and Napoleon are yet in service—a tribute to the ability and courage of the engineers and architects of a century and a half ago. Because of their long vision, and because the rulers who today stand out historically as great leaders, made it possible for their conceptions to become realities, important changes have been infrequent.

Today, however, major projects, forced by the growth of street and highway traffic, are under way, which will greatly modify and facilitate transportation in the area, but all are in harmony with, rather than destructive of, traditional values. So carefully are the projects designed to accord with the existing comprehensive plan for remodeling the city, with the old but yet fine buildings, with the principal boulevards and streets, and with the parks and other important public areas, that on completion they will have added greatly needed facilities presenting the appearance of graceful growth.

Paris is not static—it is dynamic—and from this situation we can obtain real wisdom. This example challenges the great fallacy, so common in this country, of regarding the physical environments of people as permanent—of regarding as almost sacred public works that have not yet physically deteriorated to the point of structural failure.

CIRCULAR AND RADIAL HIGHWAYS

We can get wisdom from what is being done there for two good reasons: first, the plans have been developed and the work is being executed by the National Department of Highways, the whole personnel of which has been trained in the Ecole des Ponts et Chaussees, the French School of Roads and Bridges, whose beginnings go back at least to Louis XV and possibly before. This organization is entitled to the highest respect for its engineering standards developed over a long period.

Second, there is the test of time—one and one-half centuries permit a sound perspective that distinguishes between enduring principles and short-lived stopgaps.

So it is of the highest significance that the competent French department of highways has selected, to meet two problems of traffic congestion, two distinctive types of highway planning—first, an intercepting circular highway enclosing the city, and second, motor highways, radial from the city, reaching for a considerable distance beyond to connect with the existing national highways. This idea sounds simple, but in the detail of design lies the assurance of permanent relief to the traffic, and self preservation of efficient functioning through a long future period.

OLD LINES FOLLOWED

There was a time when Paris depended for defense on fortified walls extending around the city. At intervals, gates provided for the flow of traffic to all parts of the nation. These lines yet remain the major radial highways within and without the city, perpetuated in a national system of highways, originally adequately conceived and subsequently adhered to faithfully.

On the location of the old fortification a modern highway is under construction. The abandoned walls have long since served their purpose, but through the years has been preserved, free from encroachment, the land which now becomes the right-of-way for a highway that will serve to carry traffic rapidly to connections with all of the radial streets and highways in and out of the city.

At intersections the new circular highway is carried under the major radial routes. At some points these underpasses are relatively simple tunnels, beginning and ending far enough back of the intercepted streets to leave their full width available for traffic. Others are multiple-lane tunnels branching to connect with several streets.

The design motive is to carry on separated levels the principal conflicting lines of travel to make possible a continuous traffic flow. The tunnel construction has necessarily provided for other underground services such as sewers, water and electric conduits.

NEW TUNNEL LIGHTING PRINCIPLE

A feature that is new and highly desirable is the equalization of the intensity of lighting within and without the tunnels. This is accomplished automatically by the use of the photo-electric cell control, an achievement in tunnel lighting which destroys the unpleasant reactions to driving underground.

It is my judgment that the French engineers have developed a new principle in the lighting of tunnels that will apparently overcome the

Resolution No. 3

Secondary Road Funds

WHEREAS, The American Association of State Highway Officials has realized that improvements on the Federal Aid System have advanced to such a position in many states where State and County roads, as feeder roads to the Federal Aid System, can well receive recognition in the expenditure of Federal Funds; and

WHEREAS, This Association so expressed itself to the Congress last year, as embodied in Section 7 of the Act of June 16, 1935; and

WHEREAS, The Congress in that Act authorized an appropriation of $25,000,000 a year for two years, to be expended under the provisions of the Federal Highway Act, which amount must be matched by the States;

THEREFORE, BE IT RESOLVED, That this Association, in convention assembled in San Francisco, California, December 10, 1936, hereby expresses its gratification of this action on the part of the Congress and recommends that the rules and regulations for the expenditure of these funds should provide that the State Highway Departments be the sole point of contact with the Federal Government and that the entire program, including selection of the system, designation of projects, the preparation of plans, award of contracts, and the prosecution of the work, be under the direct control and supervision of the various State Highway Departments; and

BE IT FURTHER RESOLVED, That the Traffic and Economic Surveys now being made cooperatively by the States and the Federal Government be used in the determination of the routes which are to be included in the Secondary or Feeder Road System and that the information obtained from these surveys also be used in determining individual projects within the system.



Convention comrades of American Association of State Highway Officials get together again in San Francisco. Left to right—L. V. Murrow, Washington, retiring Vice President; Gibb Gilchrist, Texas, retiring President; J. H. Dowling, State Highway Engineer of Florida; C. H. Purcell, California State Highway Engineer; Louis S. Cain, Territorial Highway Engineer of Hawaii; F. E. Everett, Executive Committeeman, New Hampshire.

generally unfavorable reaction, and will go far to popularize the use of this form of construction where it is the feasible answer to the problem.

Typical of the new radial highways is the St. Cloud auto road under construction on a wholly new location, to provide for a continuous flow of traffic to the northwest, beginning at the Seine River and connecting with the existing national system at a considerable distance from the city. A new bridge is under construction across the Seine, and this new highway will pick up the traffic at the bridge head.

PARK SETTING PRESERVED

After ascending a short grade to the level of a suitable soil stratum for tunnel construction, the line is carried beneath the St. Cloud hills. This ancient park and historic setting are thus left undisturbed, and beyond, the way lies through State forests and other lands on a wide right-of-way with all cross traffic separated. If pedestrians or bicycles are permitted, by-paths will be provided exclusively for them.

As a part of this new development program, many of the old city bridges over the Seine are being replaced by new structures, but great care is taken to preserve the architectural harmony of the new with the old. These examples typify the plans to expand highway facilities to meet new conditions where the problem is one of adding to a system of highways originally laid out on a well conceived national basis.

They sustain the principle that over a long period, a highway system originally well planned can be expanded to meet the growing needs without large abandonment of investment or changing to wholly new policies.

In Germany a wholly different situation is met. Until the present National Socialist Government took over the development, in 1933, of a national system of highways, the work was on a State and local basis. The situation is graphically described by Dr. Allmers, President of the National Association of the Motor Industry of Germany. Quoting Dr. Allmers:

"In Germany there was a hopeless state of disintegration as in the Middle Ages. State and provincial governments, district and communal authorities, made every effort to obstruct a sound development based on uniform principles. The Ministry of Transport was powerless, and years elapsed before applications were sanctioned by the competent governments of the federal states.

Every district road engineer built his roads in a different way, but nearly all of them built them in the wrong way, and only a few appreciated the requirements of automobile traffic and these few mostly lacked the necessary funds."

Here no national system had been planned and developed through the years, so it was necessary for the present German government to attack the problem of adequate national highways at the beginning. A two-part program was undertaken—the rehabilitation of the existing roads, which have been divided into national roads and highways of the first and second class. The work on these lat-

(Continued on page 15)

Great Progress Made in Mountain Road Construction

By LACEY V. MURROW, Director of Highways, Washington

THE history of the development of transportation is analogous to and parallels exactly the history of the progress of civilization. Only with the overcoming of the great natural barriers which separated one group from another, and the subsequent intermingling of ideas and accomplishments, has civilization been stimulated to new development * * *

The fact that mountain ranges have been the greatest factor in retarding the advancement of civilization is fully demonstrated in the settlement of our own country. For a period of one hundred and fifty years the Appalachian Mountains prevented the American civilization, composed of thirteen colonies scattered along the eastern seaboard, from penetrating into what was then called "the West."

The first settlers crossed this barrier in the year 1767. However, it was not until 1806 that the Great National Pike was forced through the Cumberland Gap and it was not until forty-two years later, in 1848, that this road reached the border of what is now Illinois.

EARLY PROGRESS SLOW

In contrast to this slow advancement across mountain barriers we find that during the same period the Spanish colonists to the south and the French to the north, by reason of their ability to move along navigable water routes, were many years in advance of the settlers who arrived from the Atlantic seaboard. To further indicate the slow progress made in the early development of roads, it is interesting to note that Lewis and Clark reached the Pacific Coast in 1806, which was the same year that the Cumberland Pike was started. * * *

The crossing of the Rocky Mountains was made less difficult by reason of the strong incentive to reach California when gold was discovered in 1848. Although speed was of the utmost importance, the difficulties and hazards of overland transportation were so great that many people chose the longer, time-consuming route around Cape Horn or across the Isthmus of Panama.



LACEY V. MURROW

The next major step in removing mountain barriers was accomplished in 1869, when the first transcontinental railroad was completed. It was not, however, until the advent of the motor vehicle in 1900 that really rapid progress was made in the development of mountain transportation. In 1905 there were approximately eight thousand motor vehicles in the United States, while in 1936 motor vehicle registration reached the enormous sum of twenty-six million. In order that these vehicles might be operated it was of course necessary that highways be constructed and then properly maintained.

Perhaps the most interesting feature in the development of motor transport in so far as highways are concerned is again the removal or the overcoming of mountain barriers. The topography of the country is such that this problem has been most pronounced in the western states. Most persons are familiar with the mountain roads built a number of years ago. With the advent of motor freight trucks and fast-moving passenger cars it has become necessary that careful study be given to the standards of location and construction on all primary highways, but particularly on those roads traversing high mountain ranges.

In the State of Washington all roads have been carefully segregated into one of five different classifications, this classification being determined generally on the basis of traffic density, and for each one of these classifications there have been established definite standards governing alignment, limiting grades, sight distances and superelevation.

Our mountain road location is generally subject to the following limitations: Maximum curvature, 10°; maximum grades, 5½%; minimum sight distance, 750 feet; superelevation based on Moyer's formula giving a maximum rate of .13 of a foot per foot of width.

In each of the four highways crossing the Cascade Mountains we have encountered marked differences in the types of soil and rock. Soils are found that exceed the extreme limits set for soil classification of A-1 to A-8. The rock at higher altitudes is generally of volcanic origin, breaks large, is coarse-grained and deficient in toughness. At the lower elevations the rock is generally basalt, granite and schist. Surfacing materials and aggregates for concrete or bituminous construction are available from large glacial deposits of sand and gravel.

OBSTACLES ARE NUMEROUS

The actual construction of mountain highways is more difficult than ordinary construction because of the shortness of the construction season,



With average total annual snowfall on some highways exceeding 600 inches, snow removal is a big problem in Washington as shown in this photo of highway crew at winter work.

the different types of materials encountered and the heavy yardage involved. In most of the western states you will find solid rock cuts in which the material excavated will total in excess of 75,000 yards.

We have just completed a project on the west side of the Cascade Mountains on which the yardage of one cut totaled in excess of 650,000 cubic yards. Where it is necessary to take support along steep canyon walls, there are many instances where the cut slopes will exceed 350 feet.

One of the major items of cost in the construction of these roads, particularly in and adjacent to the Olympic Mountains, is the item of clearing and grubbing, and in some instances the combined cost of these two operations exceeds $2,000 per acre. On one contract recently completed, many of the trees averaged in excess of eight feet in diameter and there was removed an average of 50,000 board feet of merchantable timber throughout the entire length of the project.

It is most difficult to secure proper locations through this type of country. After the highway has been constructed and this heavy growth of timber is later removed, it sometimes becomes very evident that the proper location was not secured. To overcome this and other problems incident to mountain locations, the use of aerial photography has become increasingly necessary and important. By proper use of the aerial method of mapping, it is comparatively easy to secure the best location the country affords. We have employed this method quite extensively in making reconnaissance and preliminary studies on all highway locations traversing difficult terrane.

SNOW REMOVAL PROBLEM

The maximum precipitation in the State of Washington is 160 inches, while the average precipitation for the state is 27 inches. Yet in eastern Washington there are hundreds of square miles with average annual precipitation of less than eight inches.

In the western portion of the state 70 per cent of the precipitation occurs between October 1 and March 31. Abnormally rapid runoff is occasioned by Chinook winds and by conditions caused by the proximity of the warm Japanese Current. All of these factors must be carefully considered in the design and construction of drainage facilities. Furthermore, it is necessary that ample clearance be provided on all structures for the passage of large trees that have been uprooted and carried into the channel of the stream by heavy winds and slides.

One of the interesting problems incident to mountain location, construction and maintenance is that of snow removal. We have in the State of Washington two mountain passes on which the average total snowfall exceeds 600 inches per year and two other passes on which the total snowfall is in excess of 400 inches. The removal of this snow is handled by the combined use of blade and rotary plows. It is estimated that we remove annually from the primary highway system in excess of 35,000,000 cubic yards of snow. Much of this snow is exceptionally heavy and weighs as much as 40 pounds per cubic foot.

The major portion of the communication problem of the department is handled by our own short-wave radio system, all plows being equipped with both transmitting and receiving sets. In many instances our snow camps are far removed from telephone or telegraph communications and during the snow season this type of com-

munication is not reliable because of the damage to lines caused by falling timber.

We have found that our communication problem has been practically solved since we have been permitted to make use of radio, as the SnoGos can immediately contact each other, the summit station or the district and headquarters offices in case of emergency.

TUNNELS ARE IMPORTANT

Because of the ever-present danger of snow slides and because of the actual loss of life and property by reason of these slides during the past few years, it has been necessary that we give more consideration to the construction of tunnels wherever feasible, in order that grades and curvature may be reduced and the hazard of heavy snowfall may be eliminated.

Traffic in the mountainous sections of Washington is now making use of sixteen tunnels, having a combined length of 6490 feet, and we are at the present time considering the widening, ventilating and lighting of the old Great Northern tunnel through the summit of the Cascade Mountains, having a total length of 13,900 feet.

The construction of mountain highways in the State of Washington is not unlike the work that may be observed in most all of the western states, particularly in California and Oregon, as the Cascades and the Sierra Nevadas form a seldom-broken chain from the Canadian boundary to central California.

But mountains have lost most of their terror. With the aid of funds provided by the Federal Government through the Bureau of Public Roads and by the various states through taxation of motor transport, it has been possible for the engineering profession to overcome in a large measure these obstacles to rapid transportation, just as most of the other natural resources have been harnessed into public service through Federal, State and municipal cooperation.

VISION IS REALIZED

Today we find that from our convention city two gigantic bridges have been thrown across the Bay of San Francisco to unite the surrounding cities into one metropolis. In southern California the long caterpillar of steel which has been creeping across the deserts from Boulder Dam has reached its destination, Los Angeles, bringing with it a steady flow of water that fell originally on the slopes of the distant Rockies.

The Moffat Tunnel has defied the stony barrier of the Rockies and has put Denver on a quick, direct transcontinental railroad route. At Grand Coulee, in eastern Washington, the waters of the Columbia are being impounded to furnish power and irrigation for a vast new agricultural empire, and Oregon can well be proud of the Bonneville project, which will harness this same river to provide electricity.



Building a highway along the face of a sheer cliff in Washington state.

Delegates From Alaska, Hawaii, British Columbia

WHEN the roll of states was called on the opening day of the convention of the American Association of State Highway Officials some of the larger delegations were given ovations as their members arose as the names of their respective states were sounded.

In honor of one of its popular sons, Gibb Gilchrist of Austin, State Highway Engineer and retiring president of the association, the Lone Star State sent 29 delegates to the convention.

Missouri was a close second with 25 delegates and Kansas was a runner-up with 24.

DELEGATES FROM AFAR

The Kansans were accompanied by nine ladies and the Missouri and Texas contingents each brought seven of the fair sex.

Sharing applause with these delegations were four delegates from Hawaii, two from British Columbia and one from Alaska.

California, naturally, as host, led all the states with 248 delegates and their ladies officially registered.

Other honor states and the numbers of their delegates and ladies were:

	Delegates	Ladies
Florida	23	6
Arizona	15	5
Maryland	14	4
Nevada	14	4
Michigan	14	3
Oregon	16	4
Utah	14	2

During our own generation, mountain highways in the United States have developed from a vision to a successful reality. Every year engineers perfect some new points, some modernizing method to increase the comfort and safety of the mountain motorist.

There is very little pioneering left to do on the overland routes, only improving and expanding to meet traffic needs of the future. However, in order that we may retain faith in the vitality of our civilization, transportation is now taking to the air—and once again the mountains raise their heads, a treacherous barrier to be overcome by the pioneers of the airways.

Message of Welcome by Governor Frank F. Merriam

IN HIS address of welcome to the convention, Governor Frank F. Merriam said:

"The twenty-second annual meeting of the American Association of State Highway Officials is an occasion of more than usual significance. On behalf of the people of California, I sincerely welcome you as delegates to this convention. We invite you to accept the hospitality of our Division of Highways in the earnest spirit in which it is offered. We are glad to have you here.

"During your visit we want you to become familiar with the problems and plans involved in the construction and maintenance of our avenues of travel.. We ask you to observe the inventions and methods which have enabled the State, cities and counties to build a system of roads and boulevards totaling approximately 95,950 miles in length. We particularly invite you to study our bridge building program together with our ways and means of financing these great projects.

"For those interested in beauty and magnificence, California has much to offer. Scenic attractions which vary from lofty mountains to vast deserts are all within a day's ride from the city. The romance of Old Spain and Mexico; the heroism of the argonauts of '49 still live within this area—milestones in the colorful history of the State.

"In the national parks nature has created an environment to which people from all parts of the world respond with enthusiasm. Lofty trees, thousands of years old, originating at a time when the world was overrun by strange creatures, still stand serene and indifferent to the passage of centuries.

"In these places, where time has stood still, nature presents a scenic setting which should be visited during your stay. Sights, wonderful and inspiring, that will remain in your memory forever are yours for the visiting. Automobile caravan tours north and south have been arranged for you.

"In selecting California in which to hold your convention, you have chosen well. To those who have never been here before, there is much to see, to learn, and to appreciate. And they are all yours, created for you and maintained for your enjoyment. See them and grow to admire them as we do, for in the field of engineering man is fast approaching the greatness of nature in his accomplishments for the comfort and convenience of humanity.

"WE WELCOME YOU."



GOVERNOR FRANK F. MERRIAM

$144,380,687 is Total of Gas Tax Diversions

UNANIMITY of opinion against gasoline tax diversion among delegates to the twenty-second annual convention of the American Association of State Highway Officials as expressed in general sessions and group meetings was one of the highlights of the Association's San Francisco gathering.

The Committee on Publicity and Public Relations adopted a resolution recommending that all States write into their constitutions, as five States already have done, prohibitions against the diverting of gasoline tax revenues.

$10,000,000 INCREASE IN 1935

In its annual report, submitted to the convention, the Association said:

"Diversion of funds secured by motor license fees and the gasoline tax from the purposes originally intended, namely—highways—was increased during 1935. In 1935 there were fifteen States that did not divert any of these funds and two States diverted but a little over $2,000 each. The reasons given for these diversions in most cases are called 'relief'; and despite the Hayden Amendment, penalizing a State for increasing these diversions, the total increased diversions of 1935 over 1934 amounts to over $10,000,000.

"Reports from State Highway Departments show that $33,909,671 in motor fees and $101,471,016 in gasoline taxes were diverted, making a grand total of $144,380,687.

"In addition to this, from the $12,451,000 collected from Motor Carrier taxes, there was a diversion of over $2,069,000. The diversions are reported as follows: $86,404,383 direct to State Treasuries, and of this amount $13,873,143 was then transferred to cities and counties. Relief was given $15,365,016; education received $30,773,143; the remainder, $13,907,169, was expended for airways, harbor improvements, Confederate pensions, oyster propagation, parks, hospitals and various kinds of bond issues—not highway bonds."

Varied Aspects of Detour Construction Problems

By T. H. DENNIS, State Maintenance Engineer, California

THE subject originally assigned for discussion at this time was to be "Maintenance on Detours on Construction Projects Under Heavy Traffic." However, since common practice during recent years has tended more and more to relieve Highway Maintenance Departments of responsibility for this particular phase of maintenance work, I have taken the liberty to digress somewhat to also include other aspects of the detour problem.

"Maintaining Traffic" is now considered as a definite integral part of every construction project.

To satisfactorily accommodate regular traffic while construction is in progress is necessarily more expensive than under normal conditions, and this added cost must come from revenues allocated to the highway department. The decision as to how much may reasonably be allotted for this purpose must be made along with all other items entering into the cost of the proposed improvement.

GOES INTO CONTRACT

Since the movement of traffic must be integrated with each step of construction as the project develops, the logical consequence has been to specify "Maintaining Traffic" as one of the duties and responsibilities of the contractor.

Each construction job presents its own distinct detour problem and for this reason General Construction Specifications must be supplemented by Special Provisions which clearly indicate what will be required of the successful bidder in this regard.

It is this policy of delegating to contractors the task of "maintaining traffic" that has to a large extent removed the problem of "Maintenance on Detours" from the Highway Maintenance Departments. Naturally, knowledge concerning maintenance methods and costs enters into the determination of the type of detour chosen; but aside from this,



T. H. DENNIS

the present-day detour is primarily the problem of the location engineer and the construction engineer.

The ideal detour from the standpoint of the traffic which will use it the most would seem to be that which most nearly parallels the existing road and at the same time provides a mimimum of inconvenience in the matter of time, comfort, and safety.

ROUTED THROUGH JOB

Regardless of how the through traffic is routed, local traffic originating within the limits of the contract must be given some sort of a traversable road. Any added expense for such a purpose is eliminated by a detour which closely parallels the existing highway, while at the same time the minimum mileage assured by this type of location works to the advantage of all traffic. As the result of such considerations, we find in the majority of cases that traffic must be routed through the job.

To care for heavy traffic the detour should be designed to provide for the continuous movement of at least one lane of traffic in each direction. One-way traffic controls are distinctly unsatisfactory and can only be justified by extreme conditions. If resorted to at all, they should extend only the shortest possible distance.

Grade and alignment standards need be only high enough to assure a moderate rate of speed and obviate the possibility of heavy trucks' becoming stalled.

WIDE COST VARIATIONS

The one great problem presented by detours is that of accommodating their temporary nature to the fact that they must also be safe and dependable at all times while in service. For this reason the expenditures for detours can bear no very definite relationship to the total number of vehicles that will pass over them.

In an attempt to establish some such relationship over a period of years and covering many separate contracts, we have found the very widest variations, from as much as one-half cent per vehicle mile down to such infinitesimal amounts as to be almost negligible.

The complete costs properly chargeable to detours are difficult to ascertain where "maintaining traffic" is included in unit bid prices, as there is no way of determining how much was added by the contractor to his unit prices in view of the fact that he would have a large amount or small amount of traffic to handle. Only those additional units of work directly traceable to traffic maintenance requirements can be accounted for.

This does not mean that any part of the cost is escaped, for, regardless of our inability to segregate it, we may be sure that it forms a definite part of the total cost of the improvement.

MOUNTAIN AREA PRACTICE

Detours in mountain areas call for particularly well planned construction schedules, in order to utilize as detours in proper sequence certain

portions of the existing road and the new roadbed, which at comparatively small expense can be made serviceable as a detour long before the actual pavement is completed.

Slight shovel-widening of cuts and additions to existing fills at carefully chosen points, will often make it possible to maintain traffic through the job with only small inconvenience to both the public and contractor, and without going beyond the cross-sections of the proposed construction. To do this may very likely change the balance of quantities in the original mass diagram, but the savings over the alternate of building a separate detour will more than offset the added expense of overhaul.

In the valleys it is generally possible to provide a detour within the right of way alongside the existing road. Unless the natural soil is especially unstable, a comparatively small layer of suitable road or plant-mix oil surfacing material will be sufficient to furnish an adequate roadway for the short length of time it will be in service. The surfacing material can later be salvaged at small expense for use on the improved shoulders of the new highway.

TIME BIG FACTOR

The length of time a detour is to be in use is of especial importance. Detours for the entire length of a project from the time work is begun until the contract is finished are very expensive.

Every piece of the existing road should carry the traffic until construction operations make this impossible; and the new construction should be put in service as quickly as grading operations will permit. The material for subgrade can ordinarily be used as surfacing material for temporary traffic and with little expense can later be reshaped for the final pavement.

Where the existing traffic is heavy, any new roadbed constructed will be sufficiently wide to accommodate two lanes of traffic on each side of its center line by utilizing the shoulder widths, so that during pavement operations, if necessary the pavement may be laid one-half width at a time and still maintain traffic. Here, also, any surfacing material required for that part of the detour which is on the shoulders can be salvaged for the improved shoulder work or the new road.

In certain cases, existing county roads offer a satisfactory means for detouring traffic. However, this is much less common than might be expected. Too often the increased mileage makes such a detour very objectionable to regular traffic, and, as previously pointed out, local traffic along the line of the project must still be provided for. Where county roads do present the best solution, the consent for their use is obtained from the county authorities and the necessary work of preparation and maintenance is handled either by the contractor or by State forces, all costs being assessed against the construction project.

Where bridges are to be replaced or reconstructed, it is often possible by slight changes in the alignment of the approaches to build the new bridge alongside the existing one, which can then remain in place until the new structure is ready for service. Where this is not possible, a temporary bridge with the necessary approaches is almost invariably the only solution, as existing bridges which might be used as detours are seldom to be found within a reasonable distance.

SOME IMPORTANT DETAILS

Many minor details, which, if considered separately, would appear to have no great importance, may very easily, if neglected, make all the difference between a detour which is accepted without complaint by the public and one which may bring a storm of criticism. Among such things are proper publicity in advance that a detour is to be used, directional and warning signs that can not be overlooked or misunderstood, adequate lighting, intelligent flagmen, and the reduction to an absolute minimum of the occasions when traffic is halted entirely. Where detours must cross railways at grade, it is mandatory that flagmen be on duty continuously.

Constantly increasing highway traffic demands increased highway facilities in the way of new roads, improved roads, replacement of worn-out pavements, and so forth, but it also demands reasonable provision for its movement while these new facilities are being prepared. The public which creates this traffic seems entirely willing to pay for these things. Their willingness to pay for adequate detours does not, however, justify the highway engineer in a lavish use of highway funds for a temporary benefit.

This situation challenges one to discover the nicest balance between the expenditures for the temporary and the permanent benefit of the public. The professional training of the engineer will tip the balance in favor of the permanent unless offset by appreciation of the fact that to all of us, as humans, immediate good has some very distinct advantages.

Resolution No. 4

Labor and Hours of Work

WHEREAS, The quality and economical performance of highway work is very largely dependent upon the ability of employees in the skilled and intermediate grades of labor; and

WHEREAS, There has been and is a distinct shortage of these classes of labor, and the present system of employment does not tend to train other men in these grades of labor; and

WHEREAS, Highway work is seasonal in character and it is difficult for labor to earn a proper annual income during the construction season;

NOW THEREFORE, BE IT RESOLVED, That the American Association of State Highway Officials requests that the rules and regulations on Federal Aid work be so changed as to permit the employment of labor in both the skilled and intermediate group directly by the Contractor, to the end that he can not only have control in the selection of such employees but will have opportunity to train other competent young men to properly fill these places as older men retire or find other employment; and

BE IT FURTHER RESOLVED, That the rules and regulations be so changed as to permit a maximum working month of sufficient hours so that labor employed upon highway construction will have opportunity to earn a reasonable annual income.

Auto Manufacturers Interested In Highway Safety Campaigns

By PAUL G. HOFFMAN, president, and D. G. ROOS, technical advisor, The Studebaker Corporation

Progress made by the automotive manufacturers in keeping pace with modern highway construction by increasing the safety design of automobiles was outlined in a highly interesting paper prepared by Paul G. Hoffman, president of the Studebaker Corporation, and D. G. Roos, technical advisor to the corporation, and read by Mr. Roos at the San Francisco convention of the American Association of State Highway Officials. The address in part follows:

THERE are today four great methods of transportation which carry the major part of the world's passengers and goods—ships, railways, airplanes, and motor vehicles. Ships travel the ocean wastes. The highway is nature's. Therefore, the technique of ocean travel is concentrated on the ship, the personnel operating the ship and the creation of imaginary lines of travel and exact codes for governing the highly trained operating personnel Density of traffic is not a problem. Speed, in spite of the fact that it has doubled in forty years, is not yet a problem.

Very much like it is air travel. The highway is nature's own. The travel lanes are imaginary routes along radio beams and at different levels. Little can be done with the highway of the air. Hence, elaborate control of the qualifications of operating personnel is necessary, as are also exacting tests and inspection and building codes for the airplane structure itself and specific codes of operation in flight. As yet density of traffic is not a problem of air flight. Speeds are the highest man has attained and greater speed is coming. Strangely enough, in a measure greater speed will mean greater safety.

Railways have a definite traffic problem. It is a major problem in their economy, but the railway builds and owns its right of way. It has its equipment and rolling stock designed and built to its requirements. It operates from top to bottom with highly trained personnel, with rigidly enforced codes learned from experience.



D. G. ROOS

Unlike any of these, and yet carrying the greatest volume of traffic in the world is the highway system of the United States and unlike any of these, the three great factors of vehicle, highway, and operator are entirely separated from each other in control. Problems in highway transportation arise therefore from maladjustment between the capacities of the driver, the car and the highway and it is not an academic question to ask how the balance between the three factors of driver, car, and highway, is to be established to produce an effective and satisfactory result.

It is inconceivable and, I believe, would not be tolerated by the public, which is our boss and yours, to destroy the facility of the vehicle and stultify its development, though all recognize that pending driver and highway improvement the capacity and characteristics of the vehicle must be subject to reasonable control.

MAGNIFICENT ACCOMPLISHMENT

Our present highway system, with all of its difficulties, is a magnificent accomplishment. It has no parallel anywhere else in the world. It has been made possible by great skill in highway engineering backed up by aroused public opinion and a demand for adequate highways. The automobile manufacturers have a fundamental interest in highways. They are the right of way over which their rolling stock must travel. Without adequate highways, the country could never have been motorized to the extent that it has, and further growth and development of the motor vehicle in both volume of production and improved characteristics is dependent on further growth of our highway system, both as to extent and type of highway.

It is unnecessary to call your attention to the fact that the problem of highway traffic is dynamic, not static. In 1908 there were about 200,000 motor cars in the United States. The annual mileage of these cars was about 80,000,000 miles, the average

(Continued on page 34)

Cutler of Kentucky, New President
True of Wyoming, Vice President

VETERAN of the World War with two citations for bravery under fire and nationally known for his accomplishments in the field of engineering, Thomas Henry Cutler, newly elected president of the American Association of State Highway Officials, assumes the responsibilities of his important office excellently equipped to fulfill the duties devolving upon him.

Born at Fort Scott, Kansas, August 12, 1882, Mr. Cutler received his degree of Bachelor of Science in Mining Engineering at the University of Kentucky in 1903.

Upon his graduation from college, Mr. Cutler entered the employ of the C. & A. Railroad as a draftsman. During 1904 he was chief of party, location and maintenance for that corporation and in 1905 accepted the post of chief of construction with the Illinois Steel Works, South Chicago. From 1906 to 1909 he was Chief Division Engineer for the same corporation at Gary, Indiana. For seven years, 1910–17, he was engaged as a construction engineer and contractor at Gary.

Mr. Cutler entered the service of his country in 1917 and served as Captain of Engineers, Division of Gas Officers, 26th Division. He served with this outfit for nine months, being commissioned a Major in the Chemical Warfare Service in September, 1918. He won his citations in field combat.

After the war, Mr. Cutler became associated with the Missouri State Highway Commission and from 1919 served successively as Project Engineer, Assistant Division Engineer, Assistant Construction Engineer, Construction Engineer and, since February 1, 1927, as Chief Engineer of the Missouri Highway Commission.

Mr. Cutler was secretary of the Gary school board and treasurer of the Gary Y. M. C. A. He was secretary and later president of the Mississippi Valley Conference of State Highway Departments, vice president and member of the executive committee of the American Association of State Highway Officials, president and member of the executive committee of the American Road Builders Association, member of the Works Commission of the State Planning Board of Missouri, U. S. Delegate to the International Road Congress, and is a member of the American Society of Military Engineers, the Missouri Historical Society, Engineers Club of St. Louis and Alpha Tau Omega.

Mr. Cutler's home is in Jefferson City, Missouri.



THOMAS HENRY CUTLER

JAMES B. TRUE

They elected James B. True of Cheyenne, State Highway Superintendent of Wyoming, to succeed L. V. Murrow of Washington to that office.

The new vice president of the Association was born in El Paso, Texas, in 1887, was educated in the public schools of Denver, Colorado, Denver University and University of Wisconsin. He was an officer and field engineer in Shoshone, Colorado, during 1907. In 1908 he went to Garden City, Kansas, to be resident engineer for the U. S. Sugar and Land Company. He returned to Colorado the following year to become engineer for the Antlers Orchard Development Co. at Silt. In 1910 he went to Suffield, Alberta, Canada, where for three years he acted as Division Engineer for the South Alberta Land Co.

In 1913 he returned to his native land and the State service until 1919, when he went into private practice.

Called back into State service, Mr. True was appointed State Highway Superintendent of Wyoming.

How Ladies Were Entertained
Impressions of a Hostess

By MRS. JOHN HUNT SKEGGS
Chairman of Hostesses

NOT the least of the Convention's activities were those especially planned for the ladies.

They arrived—about two hundred in number—from Maine to California and Honolulu, Montana to Florida; and departed, we feel, with an impression second to none of previous conventions, due to the hospitality extended to them by our California hostesses and the activities so thoughtfully and ably arranged by the entertainment committee, under guidance of Mrs. George McCoy and Mrs. Chas. H. Purcell.

The program was initiated by a delightful luncheon at the Sir Francis Drake Hotel, under the supervision of Mrs. Clarence Morris and Mrs. Walter McGinn, followed by a style show from Joseph Magnin's. There was a "Shirley Temple" and a "Jane Withers," but the spice of the display was the personality of a "Mae West," who stole the show, assisted by Al Lyon's orchestra.

Monday evening the delegation at large cavorted aboard the Show Boat. From the deck to rathskeller we feasted and danced, not to one orchestra, but to two.

Tuesday a caravan of 156 of the fair sex motored to Palo Alto, where a lecture was given at Stanford University Chapel, relative to the history of the university and its rebuilding following the earthquake of 1906. After luncheon, they browsed about the Allied Arts, with its old pewter, antique silver, Swedish glassware, and modern pottery in a setting almost semitropical, with strictly Spanish architecture. There the caravan dispersed, some expressing a desire to return via Bayshore, others taking Skyline Boulevard back to the city. It may not be amiss to quote Mrs. E. H. Flannery of Little Rock, Ark., who exclaimed after the trip was completed: "In the East it has always been the impression that Californians are prone to brag about their State. But I can understand now, for I have concluded it is next to heaven."

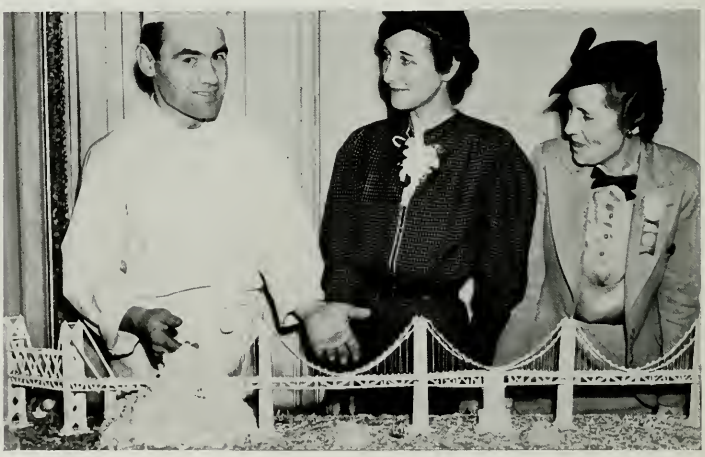
No particular affair arranged for the lovely visitors overshadowed any other, for Wednesday morning there were 102 responses to the airplane flight out of Mills Field over the bay area. Am sure our guests are most grateful to Director of Public Works Earl Lee Kelly for this featured treat, since a goodly number heretofore had either never been tempted or sufficiently urged to fly. The weather man was exceedingly thoughtful, and they all returned thrilled.

Added to the other enjoyable features was banquet night, with its

(Continued on page 17)



They enjoyed being among the California hostesses at luncheon given at Hotel Sir Francis Drake to ladies of American Association of State Highway Officials. Left to right—Mrs. C. H. Purcll, Mrs. George McCoy, Mrs. Earl Lee Kelly.



Chef Marcel Behr of Sir Francis Drake Hotel proudly shows sugar replica of Bay Bridge to Mrs. Gordon Lloyd, Austin, Texas, and Mrs. Gale Moss, Topeka, Kansas.

$800,000,000 Available Next Year If States Match Federal Aid Quotas

(Continued from page 5)

ter classes is administered, under general direction of the Inspector General of German roads, directly by the States and Prussian provinces.

The second part of the program is the laying out and construction of a wholly new system of roads known as the Reichsautobahnen, under the immediate supervision of the General Inspector. The system as planned consists of about 4300 miles, which gives roughly three lines across Germany north and south and three east and west. The literal translation of the word Reichsautobahnen is national auto road, which gives immediately a vision of these great national thoroughfares, built on their own new wide right-of-ways to provide for a continuous flow exclusively of motor traffic over the whole mileage without conflict with the cross traffic on intersecting highways or railroads.

The design calls for very easy gradients, long sight distances and long radius curves. There is some difference in these standards as applied in different areas, depending upon the general topography.

TRAFFIC SEPARATION DESIGN

The section design calls for two roadways, each approximately 29 feet in overall width, separated by a sodded strip 13.65 feet wide. Each roadway consists of a Portland cement concrete slab 24.37 feet, an inside curb 1.3 feet, and an outside curb 3.25 feet, in width. These curb strips are covered with a bituminous mix, thus giving the grayish-white center a wide black border.

Cross highway traffic is generally carried over the autobahnen without materially raising the level of these cross roads, meaning that sections of the autobahnen are placed in deep cuts. The autobahnen in some cases is carried over railways. Various types of access roads have been developed, depending upon the actual amount of traffic eventually expected.

The clover leaf design is in less general use with its 4-way connections than the so-called trumpet design. At the present time, upwards of 1000 miles of the autobahnen have been completed, although all of this mileage is not as yet open for public use.

As a national system, relative to the area of the country, this conception of the German Government goes far beyond any modern similar undertaking by any nation, when measured by miles, by the generous dimensions of the typical design, and by all of the auxiliary work, including structures, approaches and landscaping.

HEAVY GRADING INVOLVED

The construction features, as will be inferred from the description of the design, involve heavy grading. The carrying of the autobahnen below cross roads to provide high clearances alone accounts for heavy yardage because of the wide sections.

The slopes are designed to permit the quick establishment of ground cover, and all the work, even that recently finished, is well sodded. The top soil has been conserved and replaced, and in an inspection covering most of the completed mileage there was no evidence of unprotected slopes or destroying erosion.

Mechanical equipment in service is for large scale production. For hauling, use is made of industrial locomotives and small narrow-gauge steel dump cars rather than trucks which are common in this country. In the operations of pavement construction the curbs are first built. These provide tracks for steel rails on which move the combined mixer and distributor, the tamper and the finishing machines.

A very dry mix concrete is used, and is heavily tamped. The quality of construction is good. The surfaces are smooth riding, and both the design and workmanship of the structures are particularly good. While the structures are largely of reinforced concrete or of reinforced concrete substructures with steel superstructures, there are variations in the larger viaducts. In a few examples observed, masonry arches were used; long highway viaducts were largely of steel.

Where construction has been fully completed the meticulous attention which has been given to the final finish is praiseworthy, and the large scale operations reflect high-class engineering and efficient supervision. The German officials in charge, from General Inspector Doctor Todt, through the whole staff and including the workmen, can be proud of the high quility of the work they are producing.

ANTITHESIS OF AMERICAN SITUATION

There is little basis for comparison of this undertaking in Germany and the highway improvement going forward in this country. The situation in Germany is the very antithesis of that in the United States. Here the highway builders have been waging an almost losing struggle to provide highways for the already developed motor traffic. In Germany the system of superhighways is being built largely ahead of the highway traffic.

Germany has recognized the utility of highway transport to the extent of having embarked on the building of these large capacity highways, and as a complementary national policy there has been put into effect every inducement to encourage the development of motor traffic. In all of Europe the motor car has previously been looked upon as a luxury and taxed as such. The relatively slow development there resulted from high priced cars and taxation handicaps against their utilization.

Germany has not only done away with special taxes on the motor car in recognition of its potential general utility, but is actually permitting the cost price of trucks and business cars to be deducted from income on which taxes are paid. The encouragement thus offered by the Government has been so outstanding that the licensing of new cars jumped from 41,000 in 1932, to 180,000 in 1935, an increase of 340 per cent.

In addition the industry has been brought under governmental supervision, so that the commercial practices which had brought demoralization of the business have been rectified. Those most importantly interested now give highest praise to the stabilization of the industry which has thus been effected by the Government. Here we have an unusual expression of faith in the utility of highway transport.

While the highway program was undertaken as one of the means for providing employment, which, accord-



Builders of California's highways foregather at convention with Uncle Sam's head man in national highway construction. Left to right: Earl Lee Kelly, State Director of Public Works; Thomas H. MacDonald, Chief, U. S. Bureau of Public Roads; C. H. Purcell, State Highway Engineer, and G. T. McCoy, Assistant State Highway Engineer.

ing to reports, in 1932 reached one out of each three who were able to work, the policy of highway building represents a large investment on the part of the Government which there is no immediate possibility of recovering directly from imposts on the road users.

UNITED STATES MUST RAISE STANDARDS

Since conditions are so dissimilar, what relationships are there, then, which we can take as warning or which we can emulate?

The most important is that we must grasp this highway problem in this country more firmly. We must raise our standards to the new levels demanded by the universal utility of the motor vehicle.

Two distinct programs are indicated: First, the systematic rehabilitation of existing highways by the actual incorporation of new construction to promote safety and greater utility. * * * The second program is the long-time plan which will be based upon the principles illustrated by these examples from other countries, and by wide experience in our own country.

The highway transport surveys now under way are basic. It is my deep seated hope that the highway department of each State will recognize the essential quality of the information which is being gathered. If the program of the next five to ten years is to provide the public with highway service that is not now even approached in any State, it must rest on this transport survey foundation.

The underlying soundness of planning a belt line intercepting highway plus radial roads on new right-of-ways to serve the metropolitan areas, and introducing the new feature of providing this complete service only for the passenger motor vehicle, is supported by the traffic studies heretofore made.

SOCIAL SERVICES INADEQUATE

These studies indicate the overwhelming preponderance of passenger motor vehicle movements in the metropolitan areas, particularly on week-ends and holidays. To provide free flow highways leading from the cities well into the country, and to permit the distribution of vehicles on these radial highways, from and to their own quadrants in the city over one or more belt line highways, will add immeasurably to the potential utility of the motor vehicle to the urban dweller, and such development will be supported by this increased use.

This conception goes further, however, and recognizes that the trend of the world is toward a greater recognition of social values. The motor car is one of the instruments from which we are not securing the potential social services in the nightmare of congested streets or highways at times of peak traffic. Unfortunately there is no way to stagger Saturdays, Sundays and holidays. The city dweller either makes use of his car along with his tens of thousands of neighbors, or does not use it.

These radial roads will be reserved for automobile traffic. There is need in some limited sections of the country for the extension of such roads until they connect with those radiating from other large centers of population to form continuous routes wholly disconnected from our present system of highways. To the extent that other traffic, such as pedestrians or bicycles, may use such routes, separate ways must be provided.

But the design must go a step further than does the design of the German, the French or of our own roads, and provide for the complete separation of local from through travel by parallel service roads. The exclusion of local travel, as on the German roads, is unthinkable. In fact, the expanding of the cities by the development of small acreages for homes is dependent upon the provisions for local traffic service.

In our programs, both for the rehabilitation and for the long term plan, we must accept as an essential the separation of grades at major highway intersections. This is one of the most important factors in stepping up the safe utility of our existing highways.

FUTURE OBJECTIVES

Notwithstanding the very extensive operations which have been carried on cooperatively by the State highway departments and the Bureau of Public Roads, for the past several years, this discussion is largely devoted to the problem of lifting the standards of future operations rather than to the recording of the activities of these immediate years, which have been filled with earnest endeavors to give the maximum of employment.

The State highway departments and the highway contractors merit an expression of sincere appreciation on the part of the Federal officials for their diligence, patience and effective efforts to carry into effect regulations which were diverse and difficult. This problem of employment is yet with us and to a large degree will remain with us, but we can, in addition, recognize more fully that we must intelligently look at what we are doing, and determine the method of attack on these problems of highway traffic that are growing constantly more difficult.

Since the emergency programs to provide employment were undertaken in 1933, the highways put under way by the State highway departments and the Bureau from funds under the immediate direction of the Bureau have reached more than 62,000 miles. This is equivalent to at least 12 highways across the country from north to south, and an equal number from east to west. More than 21,600 miles have been included in the construction programs of the last 18 months only.

Even this immense program has been too slow. It has not with sufficient rapidity absorbed the funds available for construction. There are many causes that have delayed the beginning of work on important projects, particularly right of way difficulties, but I am bringing this observation into the discussion here since we have now to face the formulation of a new large program for the coming year.

Highway construction, including State and Federal funds, can reach above $800,000,000 if the states all meet their Federal aid apportionments. The only way that the public can be led to see its loss in the drag in State programs because of diversion of highway funds to other than road purposes is by the formulation of the timely programs that are possible if these funds are conserved and used for the purposes for which these special taxes are levied.

As an integral part of the present highway policy, the participation in the improvement of major traffic routes within the cities and the grade crossing elimination projects are rapidly maturing facilities of the utmost value. In our new program there is the introduction of the secondary road improvement program as a part of the permanent highway legislation.

Without going fully into the approach to this important new development, two principles will be observed in the regulations which are issued—first, that the Federal Government will deal only through the State highway departments, and second, that the application of the funds will be upon a definite secondary road system.

This year when the need exists to raise the standards of highway planning and engineering to higher levels, it is particularly fitting that the Association should meet in San Francisco. The intelligent vision that has produced the Bay Bridge fills the heart of every highway department member with pride to be in and of the fraternity.

The maturity of the conception, the graceful design, the complexity of the problems overcome, and the now apparent tremendous economic influence that the bridge will exert, are symbolic of what highway transport means to our nation.

The completed bridge is an enduring record of devotion to the public service of the State Highway Officials of California. To the members of the State Highway Department and the Director of Public Works, the congratulations of the highway officials of the nation. To Charles H. Purcell, Chief Engineer, to C. E. Andrew and the corps of able engineers assisting them, the acknowledgment of us all of a public service faithfully and manfully carried through to a magnificent success.

How Ladies Were Entertained

(Continued from page 14)

delightful program arranged by Mrs. Frank Balfour. Master of ceremonies was our own Leo Carillo, who parried for honors in witticism with Governor Merriam. Jean Parker of "Sequoia" fame was there in person, and all enjoyed the dancer from Cocoanut Grove, the Convention Ensemble of eight blended voices, Haskell, the Magician; impersonations by the original Syd Chatton, etc.

TRIP OVER BRIDGE

Possibly the highlight of the Convention at large was the interest displayed by the complete delegation and their wives, who motored over the new San Francisco-Oakland Bay Bridge in a parade of over one hundred cars, thus paying their respect to the colossal engineering feat of Mr. Charles H. Purcell—not losing sight, I'm sure, of the men who dared the heights under perilous conditions to make a structure of beauty and convenience for their fellow men.

Thus endeth my impression of the results of our efforts to make the Highway Engineers of America welcome and happy during their sojourn in our midst December 7-10th, 1936.

May I take this opportunity of expressing my appreciation to the corps of gracious hostesses who so ably assisted me.

May their holiday wishes,
Whether they sail low or soar high,
Cross the Bridge to Glorious Fulfillment
And be of a permanency comparable
in structure to those bridges of our
pride and joy.

"Oh, Fred, the baby has swallowed the matches. What shall we do?"
"Here, use my cigarette lighter."

Managing Director Balfour Tells How Program Clicked

TO Managing Director Frank C. Balfour and his staff of assistants is due a large measure of credit for the success of the convention, particularly from the viewpoint of the delegates in attendance.

The Division of Highways began actual preparations for the convention last September when State Highway Engineer C. H. Purcell was chosen general chairman, with Governor Frank F. Merriam, Director of Public Works Earl Lee Kelly and Mayor Angelo J. Rossi of San Francisco acting as honorary chairman.

At that time Mr. Balfour was named managing director and the following committees were appointed:

PERSONNEL OF COMMITTEES

Executive—C. H. Purcell, chairman; Harry A. Hopkins, Philip A. Stanton, H. R. Judah, Paul G. Jasper and William T. Hart, the latter five all members of the California Highway Commission.

Finance—Harry A. Hopkins, chairman; Jno. Skeggs, George T. McCoy, E. R. Higgins, F. C. Balfour, Harold Norton and Clarence E. Baen.

Transportation — Edward J. Neron, chairman; R. H. Stalnaker, S. V. Cortelyou, J. W. Vickrey, T. H. Dennis, L. H. Gibson, Paul G. Jasper, T. E. Stanton and L. V. Campbell.

Entertainment—Clarence Morris, chairman.

Subcommittee in charge of banquet—George T. McCoy, Chairman; Jno. H. Skeggs, Fred Grumm, R. H. Wilson and L. I. Hewes.

Subcomittee in charge of Show Boat—F. W. Panhorst, chairman; J. G. Standley, C. C. Carleton, C. H. Sweetser, Clarence Morris, Julien Roussel.

Subcommittee in charge of Los Angeles Caravan—L. H. Gibson, chairman; S. V. Cortelyou, J. G. Standley, Justus Craemer, Julien Roussel and Jno. H. Skeggs.

Subcomittee in charge of Redwood Empire Caravan—Paul G. Jasper, chairman; Chas. H. Whitmore, C. C. Carleton, F. W. Panhorst, J. W. Vickrey and R. H. Wilson.

Weeks in advance, an elaborate program of entertainment for the womenfolk was arranged and it was successfully carried out by the Ladies' Entertainment Committee, headed by Mrs. George T. McCoy, the Ladies' Reception Committee, of which Mrs. Jno. H. Skeggs was chairman, and the Ladies' Transportation Committee directed by Mrs. C. H. Purcell.



FRANK C. BALFOUR

The office staff which handled preliminary details of the convention and saw it through to the end was highly commended by Mr. Balfour. To Miss Helen MacLachlan, his secretary, and to Miss Genevieve Henderson, Miss Ethel Connolly and A. M. Nash, his assistants, he attributed the smoothness with which the business of the convention was conducted.

"In my opinion," said Balfour, "the registration of delegates was handled most efficiently. We pride ourselves on the fact that no delegate was detained longer than two minutes at the registration desk, even though he was not preregistered and it was necessary for us to type his registration card and type a slip with his name and State on it for his badge.

"We had 897 registrations, consisting of 559 accredited men delegates, 219 ladies and 114 guests such as materials men, equipment men, contractors, etc., of whom approximately forty per cent were from out of the State. The 219 ladies of the delegates represented considerably more than double the highest feminine registration at any previous meeting of the Association. The 559 men represented forty per cent more than have attended any previous convention. This large registration, in my opinion, was a tribute to California State Highway Engineer, C. H. Purcell."

According to Balfour, the attendance at the banquet tendered to the delegates and their ladies and guests by the Division of Highways at the St. Francis Hotel on Wednesday night, December 9, was the largest of any similar event in the history of the hostelry.

"In my estimation," he declared, "Mrs. Jno. Skeggs, Mrs. George T. McCoy and Mrs. C. H. Purcell collectively did a marvelous job."

LADIES ON COMMITTEES

Assisting these chairmen were the following committee members: Mesdames J. S. Bright, Walter McGinn, Everett Walsh, Clarence Morris, Edward J. Neron, Earl Lee Kelly, C. C. Carleton, P. A. Stanton, H. R. Judah, Harry Hopkins, W. T. Hart, P. G. Jasper and J. W. Howe.

A very busy lady was Mrs. Clare P. Balfour who arranged for all the music and entertainment both on the boat ride on San Francisco Bay and the annual banquet at the St. Francis Hotel.

Owing to the various sightseeing trips and the two automobile caravans traveling south and north at the close of the convention, motor transportation was of vital importance.

TRANSPORTATION PLANS CLICKED

"The Transportation Committee under Edward J. Neron," said Balfour, "and particularly Russ Stalnaker, L. V. Campbell and Adolph N. Sutro, did an exceptionally fine job. Transportation, as you know, makes or breaks a convention, and every car on every trip was in line, on time, left on schedule, and returned on schedule.

The Wednesday afternoon caravan trip over the Bay Bridge moved through San Francisco traffic to the University of California campus and returned to the hotel in a caravan, exactly three minutes ahead of schedule.

Forty-four States Send Delegates to Highway Convention

(Continued from page 2)

"It is true that many people think Uncle Sam should not tax gasoline, but from 1917 to 1924 his total contributions for highways was $452,000,000 over an eight-year period. During the past year alone he authorized the expenditure of $525,000,000 for State roads alone."

Mr. Markham called attention to the fact that during the last year the highway departments have constructed 2456 bridges, eliminated 480 railroad crossings and added 25,800 miles of improved highways to State systems.

43 STATES ANSWER

At the conclusion of Mr. Markham's report, the first roll call of States was held and only representatives of Maine, New Jersey, West Virginia, Georgia and Montana were missing. However, the Georgia delegation had sent a telegram announcing its members would report on the morrow, which they did.

During the noon recess, the ladies of the convention were entertained at a luncheon, style show and floor show at the Hotel Sir Francis Drake, which was tendered by a committeee of wives of officials of the Division of Highways headed by Mrs. Charles H. Purcell, Mrs. George T. McCoy and Mrs. John H. Skeggs. Later in the afternoon the womenfolk were entertained in the Persian Room of the hotel.

Vice President W. F. Callahan of Massachusetts presided at the afternoon general session of the convention, which was devoted to an address by Thomas H. MacDonald, Chief, Bureau of Public Roads, United States Department of Agriculture.

MACDONALD FORECASTS CHANGES

Mr. MacDonald recently toured European countries, studying road design and construction abroad, particularly in Germany and France. He was impressed with Germany's construction program involving the creation of 4300 miles of superhighways.

"We must grasp the highway problem in this country more firmly," he declared. "We must raise our standards to the new levels demanded by the universal utility of the motor vehicle. Two distinct programs are indicated. First, the systematic rehabilitation of existing highways by the actual incorporation of new construction to promote safety and greater utility. The second program is the long-time plan which will be based upon the principles illustrated by these examples from other countries, and by wide experience in our own country.

"The highway transport surveys now under way are basic. It is my deep seated hope that the highway department of each State will recognize the essential quality of the information which is being gathered. If the program of the next five to ten years is to provide the public with highway service that is not now even approached in any State, it must rest on this transport survey foundation.

BELT LINE PLANS

"The underlying soundness of planning a belt line intercepting highway plus radial roads on new right-of-ways to serve the metropolitan areas, and introducing the new feature of providing this complete service only for the passenger motor vehicle is supported by the traffic studies heretofore made."

Mr. MacDonald asserted that if all the States meet their Federal Aid apportionments, highway construction, including State and Federal funds, can reach above $800,000,000 next year.*

The afternoon session was adjourned in time to enable the delegates and their ladies to assemble on the Embareadero at 6.30 o'clock and go aboard the S. S. City of Sacramento for a night trip around San Francisco Bay.

SHOW BOAT TRIP

This feature of the entertainment program, unique to the out-of-state visitors, took the place of the usual family dinner, always in the past held by the association on convention opening day.

From the steamer the visitors were afforded opportunities for close inspection from the water of the brilliantly illuminated San Francisco-Oakland Bay Bridge, the Golden Gate Bridge and other points of interest.

* Mr. MacDonald's speech in full begins on page 3.

While the *City of Sacramento* cruised about the bay, there was continuous entertainment and dancing, and from 7 to 9 o'clock an excellent buffet supper was served. The boat ride was one of the highlights of the convention.

WOMAN SPEAKER HEARD

Tuesday's general session started promptly at 9 o'clock in the morning with Vice President James D. Adams of Illinois in the presiding officer's chair. The delegates heard an interesting address on "Roadside Beautification and Treatment" by Mrs. Frank W. Sorell of San Antonio, Texas.*

Following Mrs. Sorell's talk, Mr. MacDonald, Chief, Bureau of Public Roads, exhibited and explained a number of slides reproducing photographs of various examples of highways in Europe and this country designed to show the progress made in road building and to reveal types of construction which had been found to be unsuitable.

An address that was of particular interest to bridge engineers among the delegates was delivered by C. E. Andrew, Bridge Engineer of the California Division of Highways, and one of the builders of the San Francisco-Oakland Bay Bridge.

LADIES TAKEN ON TRIP

While the delegates were listening to these speakers, their ladies were taken on a motor sightseeing trip down the beautiful San Francisco Peninsula through Burlingame, San Mateo and Redwood City to Palo Alto and Stanford University, and entertained at a luncheon at the Allied Arts Inn.

Immediately following adjournment of Tuesday morning's general session, group meetings began and continued throughout the day. In these meetings many important subjects dealing with the problems confronting the nation's highway builders were discussed at length by authoritative speakers and later formed the basis for resolutions and recommendations presented to the convention and to the association's standing committees.

* Mrs. Sorell's address appears on page 28 of this issue.



Group Picture of Delegates to Convention of American Associati

A number of papers read at these meetings, which are not touched upon in this issue of California Highways and Public Works, will appear in future issues of this magazine.

DIVIDED HIGHWAYS DISCUSSED

The group meeting concerned with administrative problems was presided over by Harry A. Hopkins, chairman of the California Highway Commission. Discussion was opened by M. D. Van Wagoner, State Highway Commissioner of Michigan. His subject was: "Are the States Ready to Assume Economic Problems Involved in Starting a Program for Divided Highways?"

Among other subjects taken up by this group were what states can do to publicize their highway work the matter of greater governmental aid in the construction and maintenance of highway facilities, future Federal and State policies in the construction of feeder or local roads, what improvements can be made in relief legislation in respect to highway construction and is the nation's highway system an asset or a failure.

Charles Ross, general counsel for the State Highway and Public Works Commission of North Carolina, presided over the group meeting which discussed legal affairs having to do with highway rights of way, construction and maintenance. About thirty attorneys and Right-of-Way Agents of various States attended this meeting.

C. C. Carleton, Chief Attorney for the California Division of Highways, introduced an additional topic which called forth much discussion. It was: "Acquiring Property not Located Within the Highway Right of Way Sought to be Acquired for the Highway use Itself, For the Special Purpose of Moving Thereon Buildings and Other Improvements Existing Within the Limits of the Highway Right of Way Sought to be Acquired for the new Highway Use."

After a review of the present practice in the different States it was the concensus of the group that a further study of this subject should be made during the coming year.

In view of the fact that safety on the highways was one of the paramount questions before the convention considerable interest was evinced in the sessions of the Traffic Control and Safety Group over which W. F. Rosenwald of Minnesota presided.

J. W. Wheeler, Highway Commissioner of Indiana, opened the discussion on "The Nation's Annual Bill for Incompetent Motor Vehicle Drivers."

Mr. Wheeler advocated that the auto industry construct cars so that the drivers will have more than the present 5 per cent vision.

Joining in the discussion, Ray Ingels, Director of the California Motor Vehicle Department, declared that the highway death rate in this State was due largely to the carelessness of pedestrians.

"Pedestrians," he said, "do not know how to cross streets properly. Due to education of children in traffic safety precautions we have a low death rate among children. Adults should be educated in the same way. For greater safety and a lower death rate we should have a stricter licensing of motor vehicle drivers, sidewalks on highways, more underpasses and the teaching of all children in the fourth year of high school to operate automobiles, a practice now in effect in Indiana."

The entire subject of traffic problems, including traffic lane markings, no-passing zones, a national system of uniform traffic laws, traffic control devices and signing, was thoroughly



f State Highway Officials at San Francisco, December 7-10, 1936

gone into by the delegates attending the meetings of this group.

Numerous matters having to do with publicity, particularly the question of educating the public to the evils of gas tax diversions, were taken up by the Public Relations and Publicity Group of which J. D. Adams of Indiana was chairman.

While of a highly technical nature, the discussions of the Uniform Accounting Group were of much interest to the auditors of the various State Highway departments, the men upon whom devolves the big job of keeping track of and disbursing the millions of dollars spent on highways. State Highway Engineer H. D. Barnes of Kansas presided.

An interesting paper on "Proper Method of Accumulating Maintenance Cost Detail and Control of Cost Detail with Actual Expenditures" was read by E. R. Higgins, Comptroller of the California Department of Public Works.

With A. L. Gemeny, U. S. Bureau of Public Roads, in the chair, bridge engineers of many State Highway departments participated in the meetings of the Bridges and Structures Group.

Some of the problems of general interest to bridge engineers in connection with the building of the San Francisco-Oakland Bay Bridge were discussed by C. E. Andrew, one of the builders of the great transbay structure.

Other topics considered were working unit stresses for concrete bridge design in their relation to the physical properties of the concrete and steel, which was ably handled by G. S. Paxson, Acting Bridge Engineer of Oregon; the esthetics and design of handrails and curbs for highway bridges, which Morris Goodkind of New York discussed; present limitations on the use of welding in steel bridge construction, explained by O. J. Eidmann, State Engineer of Design of Kansas, and kindred subjects.

The Materials and Research Group, H. S. Mattimore, Engineer of Tests, Pennsylvania, presiding, discussed such subjects as requirements for uniformity of grading of aggregates for dense graded plant mix and dense graded road mix bituminous surfacing, quality of aggregates for bituminous work, the use of cut-back asphalts, methods of accelerating viscosity tests of liquid asphaltic materials and the oliensis and other solubility tests for bituminous products.

TESTS AND SOIL SURVEYS

Basing his remarks on extensive tests made in the Sacramento laboratory of the California Division of Highways, T. E. Stanton, Materials and Research Engineer, read a paper on "Pre-formed Expansion Joint Materials for Concrete."

One of the important subjects considered by the Road Design Group, O. L. Kipp, Construction Engineer, Minnesota, presiding, was soil surveys and subgrade design for most economical use of local subgrade materials, a topic which was discussed at length by C. S. Pope, Construction Engineer, California Division of Highways.

Other speakers were A. R. Nichols, Minnesota, who talked on highway landscape architecture; A. E. Palen, Bureau of Public Roads; W. E. Jones, Engineer of Design, Iowa; S. M. Rudder, Assistant Chief Engineer, Missouri; H. E. Surman, Illinois; C. F. Bedwell, New Jersey.

Fred J. Grumm, Engineer of Surveys and Plans, California Division of Highways, read a paper dealing

(Continued on page 33)

Retiring President Sounds Warning Against Diversion

By GIBB GILCHRIST, State Highway Engineer of Texas

Stabilization of the business of building highways was hailed by Gibb Gilchrist of Texas, retiring president of the American Association of State Highway Officials, as one of the outstanding accomplishments of 1936, in his address before the convention. He urged that all states plan highway construction programs not less than four years ahead, called gas tax diversion a major threat to highway progress, said Federal appropriations for secondary or feeder roads have met with popular approval, and declared the number of accidents on highways can and must be reduced. Following is Mr. Gilchrist's address in part:

THE year 1936, as contrasted with 1935, might be termed one of recession but not of retrogression in highway affairs.

It has been a year for stabilization and for planning. It has also been one of disillusionment as our people, having become accustomed to large expenditures for highways, do not like the idea of having them curtailed. In my state our program for 1937 is somewhat less than half of what it was for 1936 and it is difficult for us to adjust ourselves. It is to be assumed this has been the experience of the great majority of states.

What has been lost in quantity might be said to have been largely regained in other ways. The various relief programs have undoubtedly benefited the states in many ways. Designs have been improved by larger experience. Our engineering organizations have generally advanced and they have a feeling of confidence that has not always prevailed. While in amount the allocation is much smaller than heretofore, it must be remembered that it is just as great as any regular federal aid appropriation in the past. The best opportunity for long-range planning ever offered became the lot of the states during 1936.

HAYDEN CARTWRIGHT ACT

The Hayden Cartwright Act of 1936 included two distinctly new things—it gave to the states with the 1936 apportionment already enacted three full years of regular federal aid beginning July 1, 1936, and second, but not least, a policy was inaugurated in providing $25,000,000 for each of the years 1938 and 1939



GIBB GILCHRIST

for secondary or feeder roads to be matched equally by the states. This policy will be popular and therefore will possibly be permanent. Many other things were done by the Act of 1936 but these two stand out as opportunities.

The railroad crossing section is new in the company it keeps and perhaps will appear in other acts, but over a period of years may be considered temporary in long-range prospect. Crossing protection at isolated places is in many instances the best answer and is becoming more popular as devices are improved. Again, with the changing popular opinion on road location, and the willingness of public authorities to permit proper location, many crossings can be eliminated by relocation.

In my own experience several times as many crossings of railroads have been eliminated by relocation as by separation. In view of improvements in railroad equipment, however, highway officials should not lose sight of the fact that while the number of vehicles crossing railroad tracks has perhaps decreased, the number of actual crossings has not, and that in itself presents quite a problem, the answer to which is perhaps elimination, as far as practicable, and then protection by signals and otherwise.

LONG RANGE PLANNING

It is to be hoped that the states have taken full advantage of the opportunity for planning that the three-year program affords. The plan could and should go much beyond three years, but that much definitely is in sight.

The states are ready for this kind of procedure—the entire country is sold on the principal of regular federal aid and if I were giving advice to highway officials it would be to plan construction programs at all times not less than four years ahead and carry their general layouts much further.

SECONDARY OR FEEDER ROADS

We have much to learn about the secondary and feeder plan. Much of the discussion at this convention will concern regulations for carrying out that mandate and we will be anxious



Members of Executive Committee of American Association of State Highway Officials Convention. Left to right: C. H. Purcell, California State Highway Engineer; T. H. Cutler, president-elect, Kentucky; W. C. Markham, secretary, Washington, D. C.; A. W. Brandt, New York; P. G. Peterson, Utah; H. G. Shirley, Virginia; J. T. Ellison, Minnesota; C. B. Treadway, Florida; F. R. White, Iowa; T. H. MacDonald, Chief, Bureau of Public Roads, Washington, D. C.; Gibb Gilchrist, retiring president, Texas; W. W. Mack, treasurer, Delaware; F. E. Everett, New Hampshire.

that a proper start be made. We are all somewhat alike on our regular Federal Aid System but in our secondary and feeder problems we are as unlike as the topography that makes up our terrain. Some states have a small percentage of roads outside their Federal Aid System and in some the Federal Aid System constitutes only a small percentage of State roads.

Mr. Thomas H. MacDonald of the Bureau of Public Roads has very fairly submitted to the states the questions with which we will be concerned. How shall the system be designated; how shall the funds be apportioned; with what funds shall the government money be matched; how shall the roads be maintained; what standards of location and design shall be used—these and others and on which some divergency of opinion will be apparent—but they will be answered and the problem solved.

DIVERSION SERIOUS MENACE

It is evident that there must be broader latitude than has been necessary on the Federal Aid Highway System. One matter on which there seems to be a preponderance of opinion is that the work should be handled through the Bureau of Public Roads by the various state highway departments in the same manner as regular Federal aid. This should apply whether or not county or road district money is used to defray a part of the cost.

Diversion and attempted diversion of motor vehicle transportation taxes continues to be one of the most serious menaces to a sound well-planned highway program. Several threats of diversion have been successfully combated during the past year and other battles have not been so successful.

Some of the attempts have been centered on providing funds for some form of relief, old age pensions or unemployment insurance and other measures with which we sympathize, but more and more the thinking public is beginning to realize that the use of these funds from motor vehicle taxes for the purposes foreign to those for which they were provided is simply a form of legal pick-pocketing and have taken steps to prevent it.

Five states, I believe, have adopted constitutional amendments that guarantee funds collected from the motoring public shall be used for highway construction and maintenance.

The Congress of the United States itself has said that if the proceeds of motor vehicle taxation are not applied to highway, the tax is "unfair and unjust." It is to be hoped that section 12 of the Hayden Cartwright Act will be strictly and impartially enforced because it acts as a barrier in those States not yet protected by constitutional law.

The tax is, roughly, 30 per cent of the sales price and is a sales tax on a specialized commodity levied on the sound theory that a system of good roads is essential to social, commercial and industrial progress. Good roads are one of the nation's chief assets and States have come to be judged, in a measure, by the progressiveness with which they handle their road problems.

It would be an idle contention to argue that the motorists would submit to the heavy levies they now bear for purposes other than highways and it would be a brave "diversionist" who would be willing to submit his question to popular vote. Past diversions have crippled highway programs and strong steps

should be taken to guard against further disruption of programs from this source.

Gradually the problem of accidents on highways is being recognized and is shown in its true light. There has been a tendency to get away from scare-heads of certain forms of publicity and ghastly descriptions of individual cases and to view the situation sanely. We are also getting away from comparisons with fatalities or casualties during the wars in which the Republic has engaged and tending more to comparing our accident rate with other forms of human activity in which many millions of people are engaged.

The 1936 edition of the National Safety Council on "Accident Facts" shows that in 1934 approximately 24,000 lost their lives in falls, and nonfatal accidents of this nature reach into the hundreds of thousands. The same report shows that 31,500 people met accidental deaths in their homes during 1935, and that this represented more than 30 per cent of all accidental deaths.

REASONABLE EXPECTANCY RATE

We are too prone to consider the number of fatal accidents on highways in the thousands without thinking of how many vehicle miles were involved in the movement of traffic and how many people were riding in motor vehicles. I wonder if a cross-section of the people of the country on any active day would not show just about as many people riding in or walking among motor vehicles as would be found in their own homes or at work away from possible motor hazards. The highway accident record can and must be reduced, but the rate is perhaps not as far above the horizontal of reasonable expectancy as we might have been led to believe.

The three "E's," advocated by the National Safety Council, are important—Engineering, Education and Enforcement. In my opinion, the road designer should remember at all times that the finished product should be of such quality that the sane, sober and alert driver could travel any highway with reasonable safety, barring defects in his own equipment. Conditions can easily be created in road construction that do not gave sufficient warning to a driver of this type. The road designer at the same time should realize that mental hazards are in fact real, and should remove them as far as possible. Narrow shoulders dropping off an a steep slope into a deep ditch or gulley are frequent examples of mental hazard.

EDUCATION IN SCHOOLS

Education of motor vehicle drivers, and the enactment and enforcement of stringent laws regarding the use of the highways may be considered the most effective and quickest means of reducing the accident rate to or below the normal expectancy.

Speed is with us to stay and when you have the combination of a modern motor vehicle and a modern highway, the full utility of neither is developed if at all times the vehicle is kept under the legal speed limit on the open road. This limit in my State is 45 miles per hour for automobiles and a recent speed test checked in each of our 25 divisions showed that the average speed of 8600 vehicles was 47.7 miles per hour, nearly 3 miles on the average greater than the speed limit of the State.

Not enough motor vehicle officers could be employed to enforce the speed limit, but with a very small per annum charge, driving and license regulations could be enforced that would have a material effect. Many States are doing this now and many others will follow. The road builders have led in many activities and it is absolutely essential that steps in every State be taken to, first, remove hazards for the sane, sober and alert driver and to educate, control or punish all of the others, and to furnish men to see that the job is done.

ROADSIDES AND SIGNS

More and more of the States are looking to the aesthetic side of highway construction and to roadside improvement. The Bureau of Public Roads is to be commended for initiating this step generally in all the States, although a number had progressed quite a bit prior to that time.

As highways have been permanently located and sufficient right-of-way obtained, the designing engineer has tentatively become in his own way the landscape engineer, and with the technical advice of trained landscape engineers, has begun a revolution in the design and construction of cross-sections that bids fair to show more marked improvement and more visual evidence in the next few years than any single advance that has been made.

OUTDOOR ADVERTISING EVIL

Outdoor advertising either inside or outside the right-of-way may be put in two classes—one being where a sincere attempt has been made to improve the sightliness of the signs and represents an attempt to detract as little as possible from the roadside appearance; the other is where small boards or metal signs, probably unauthorized, are tacked to fences, trees, barns, etc., and with no attempt at symmetry or appearance.

Outdoor advertising can be done in a manner that would improve the roadsides. Much progress may be made along this line.

On a trip to Mexico City the past summer, it was noted that the new highway was reasonably free of this distraction, but where bill boards had been erected, they were in almost e v e r y case advertising American products.

The matter of unattractive outdoor and roadside advertising along our highways is one that would merit the continued and increased attention of highway officials. It has been suggested that where intensive planting projects are proposed, in securing the right of way, an easement be secured against disfigurement in this manner. What profit is it to spend public funds to improve the roadside and then have the effect nullified by unsightly and multi-colored signs?

Automobile manufactures and dealers, oil companies and others having products used on highways or in connection therewith might well take the lead in a new form of outdoor advertising which may be designed to enhance and not detract from attractiveness of the roadside.

PUBLIC RELATIONS IMPORTANT

Since the traffic pays the major portion of the cost of highway construction and maintenance at this time, the public relations angle becomes more important. Reference is made particularly to the attitude taken by highway employees toward the traveling public and especially highway employees engaged in work on the highways. An attitude of indifference toward the public creates ill-will, but on the other hand, the reverse is true when employees coming in touch with the traveling public go out of their way to be helpful and to assist in movement of traffic.

Highway Has Its Limitations In Contributing to Safety

By R. E. TOMS, Chief, Division of Design, U. S. Bureau of Roads

Responsibility for highway accidents can not be placed wholly upon the shoulders of the highway engineer, R. E. Toms, Chief, Division of Design, U. S. Bureau of Public Roads, asserted in an address before the convention of the American Association of Highway Engineers. The driver and the vehicle must be considered in analysing the accident tolls. Mr. Toms made some valuable recommendations relative to future highway construction in its relation to highway safety. His address, in part, was as follows:

HIGHWAY safety, to the extent that is possible, must result from bringing the three elements of the safety triangle into proper balance, namely, the highway, the driver and the vehicle. Each is subject to limitations that make the ideal unattainable. The purpose of this paper is to present the practical and economical limitations of the highway in contributing to highway safety.

The development of the automobile for the first time placed mechanical transportation at the disposal of the individual to be used when desired subject only to the limitations of a roadway for operation. Prior to that time all mechanical transportation had been developed for mass movement, and in mass transportation responsibility for development of the vehicle, the roadway upon which it moved, and its operation generally was directed by a single agency which made possible coordination between these elements.

In the case of railroad transportation the roadway had to be constructed before any vehicle could be operated over it. Changes in the character of vehicle required changes in the roadbed, but always the roadway was changed first to accommodate the improved vehicle.

How different has been the development of motor highway transportation. The vehicle came first. Roadways suitable for the vehicle followed. The cost of providing the roadways by and large has been collected from the owners of the vehicles during their usage of the roadways. In no other



R. E. TOMS

way would it have been possible for highway transportation in this country to have attained its present development in the relatively short period since the motor vehicle came into existence.

The rapid changes in the development of the motor vehicle have created a tremendous problem for the State highway departments. Each year new models of the vehicle are placed on the market embodying advancement in design and perfection of operation. These changes are along the lines of economy of operation, mechanical safety, greater speed and more flexible power. These vehicles are being operated on highways that originally were constructed 15 or 20 years ago. During this period the average rate of road speed has nearly doubled. It is not surprising, therefore, that a considerable percentage of our older highway construction is obsolete for present-day conditions and in urgent need of reconstruction to provide adequate and reasonably safe operation.

The greatest obsolescence is on our main highways because they represent the first and consequently the oldest construction. We are faced with the problem of obsolescence because we have constructed highways that have a longer life than the vehicles operating over them. If it were possible to replace the highways with the same frequency that vehicles are replaced, then each replacement of the highway could be made with improvements in design standards comparable to the changes made in the vehicle itself.

PROUD OF ACCOMPLISHMENT

The continuous improvement of a limited system of highways carrying the major portion of total highway traffic constitutes the first phase of highway improvement. This has been accomplished in many of the States. In other States this objective, due to limitations of funds, has yet to be reached. Highway officials have no reason to be ashamed of this accomplishment. They have provided and are maintaining the roadways used by 26 million vehicles. In the main they are dependable roadways, but not

always safe roadways except for the careful driver. The second phase of highway improvement which we are now facing and which is past due in some States must deal with the reconstruction or modernization of existing highway facilities to make them adequate for the volume of traffic using them and safe for reasonable usage.

To design or plan a utility with intelligence the uses to which it will be subjected during its period of expected life must be known. The essential elements that affect the adequate design of a highway are the speed, number, width, length and weight of vehicles to be accommodated and the safety, comfort and pleasure of travel to be afforded. The width, length and weight of vehicles concern physical characteristics which largely have been controlled by legislation. * * * Volume of traffic, speed and safety remain elements that must be appraised.

QUESTION OF SPEED

It is not the purpose of this paper to advocate unrestricted speed, or to appeal for a curtailment of speed, but rather to consider it from a wholly realistic standpoint. We know that the present-day motor vehicle is capable of attaining speeds of 70 to 80 miles per hour or more. We know that a straight road with sufficient vision may be traveled at a speed limited only by the performance of the vehicle. We know that the majority of traffic on the open road when not restricted by continuous, sinuous alignment moves at a speed of 40 to 60 miles per hour or more. We know that the trend in highway traffic as well as in all forms of transportation definitely is toward higher average speeds.

We know that in States having fixed maximum speed limits some tolerance is permitted by the enforcement authorities. We know that operators of vehicles in States having relatively low fixed speed limits, disregard these limits and the possibility of arrest by so doing. We know that no State has yet been able to establish an enforcement agency large enough definitely to restrict speed to a stated limit. We know that providing curvature on highways that safely can be traveled at high speed does not encourage high speed any more than straight sections of road. We know that excessive speed for the road curvature encountered contributes to the accident toll. We know that never in history has a top limit been fixed and maintained beyond which a utilitarian development shall not pass. We know that speed is a very essential element in adequate road design.

With this knowledge the only conclusion that possibly can be drawn is that highways must be designed to permit safe operation by reasonably careful drivers at a speed of 60 miles or more per hour.

Resolution No. 5

U. S. Route Markers

WHEREAS, There has been created a system of United States numbered Highways by the American Association of State Highway Officials; and

WHEREAS, The Secretary of Agriculture of the United States has approved the markers and emblems with which such highways are marked; and

WHEREAS, In certain cases there has been unauthorized use of such emblems or markers, and since there have been advertising signs similar in appearance used along the highways; now therefore

BE IT RESOLVED, That the American Association of State Highway Officials, in convention at San Francisco, California, on December 10, 1936, recommends that the emblem used for marking these highways be copyrighted by the American Association of State Highway Officials and its use permitted only as markers on highways which are approved by the Executive Committee of this Association.

SAFETY ELEMENT IMPORTANT

The safety element is of prime importance to every individual user of the highway. The highway engineer has a very definite responsibility to build this element into the highway to the extent that it is physically and economically possible.

We read many suggestions from well intentioned individuals about designing highways that will automatically correct for the mistakes of the driver, and that practically all of the accidents could be eliminated by applying known knowledge to traffic control. These are desirable objectives but are they possible? The answer is no, emphatically no.

The Holland tunnels under the Hudson River between New Jersey and New York City exemplify practically all known conditions that make for safety of highway travel. They have roadways in each tuunel 20 feet in width betweeu curbs that are used solely by traffic moving in one direction so that there is no opposing traffic.

There are no collision points because there is no cross traffic. There are no railroad grade crossings. There is no pedestrian traffic. The roadways are dry at all times so that drivers are not subjected to changing roadway conditions occasioned by rain, sleet or snow. The roadways are lighted day and night. Vehicles are not permitted to stop. There are no roadside distractions, such as signs or choice bits of scenery to attract the attention of the driver. Traffic officers are stationed at fixed posts commanding the best view of the greatest length of tunnel to report mechanical breakdowns so that the hazards of stalled vehicles may be reduced to a minimum. There are elevated walkways that may be used by the officers in proceeding to the scene of accidents. Wrecker service is available on call to quickly remove disabled vehicles.

Drivers using the tunnels are awake because they have to stop to pay toll before entering. They usually are alert because they are encountering something new and different. There is no deadening monotony of mile after mile of the same type of roadway and the same scenery. The only unfavorable traffic condition is that there is no possibility of turning out on to a shoulder to avoid rear-end collisions. The tunnels were opened to traffic nine years ago last month. It was expected that the one hundred millionth vehicle would travel through the tunnels last month.

ACCIDENTS WILL CONTINUE

Despite these unusually favorable traffic conditions there have been five fatalities in the Holland tunnels since they were opened to traffic. Three of the fatalities were to motorists and two were to employees. This has been hailed as a remarkable record and it is a remarkable record. The tunnels are 1.77 miles in length. Five fatalities for 177 million vehicle miles of travel is equivalent to one fatality for each 35½ million vehicle miles traveled under practically ideal conditions for safety.

Approximately 16 billion gallons of gasoline were consumed in highway travel in this country in 1935. Assuming the average vehicle to travel 12 miles per gallon of gasoline consumed, the consumption of this gallonage of gasoline resulted in a probable traffic of 192 billion vehicle miles. If it were possible to duplicate the safe travel conditions in the Holland tunnels on all of the streets and highways of this country, the fatality experience of the Holland tunnels applied to the 192 billion vehicle miles of highway and street travel in 1935 would result in 5400 fatalities for the year. This serves to give some idea of the practical aspects of highway safety.

We know that highway fatalities in cities of over 10,000 population accounted for approximately 12,000 of the total fatalities in 1935. It is evident, therefore, that despite



San Franciscans greet Hawaiians at San Francisco convention of highway officials. Left to right: Mrs. Jack Moskowitz, Honolulu; F. L. Klein, Highway Engineer, U. S. Bureau of Public Roads, San Francisco; Mrs. F. L. Klein; F. A. Kittredge, Chief Engineer, National Park Service, San Francisco; Mrs. C. H. Sweetser, wife of District Engineer, Dist. 2, U. S. Bureau of Public Roads, San Francisco; Jack Moskowitz, Highway Engineer, Honolulu, and Mrs. F. A. Kittredge.

ideal traffic conditions there will continue to be a staggering total of fatalities from highway and street use.

There are those who would create the impression that the increase of fatalities in highway and street travel is due largely to the increased speed of this travel. Accident statistics and other studies do not support this viewpoint. As a matter of fact the total fatalities measured in terms of highway and street usage were less in 1935 than they were in 1920 when speeds were materially lower than they are at the present time.

DRIVERS ACQUITTED

There were 827,000 accidents on streets and highways in 1935 that caused personal injuries from which there were 37,000 fatalities. Nearly 1,200,000 vehicles were involved in these accidents, 95 per cent of which apparently were in good mechanical condition.

It is conservatively estimated that there are 44 million drivers in this country who at various times operate the 26 million vehicles. Assuming that all of the vehicles involved in accidents resulting in personal injury in 1935 were at fault, these accidents were caused by less than 3 per cent of the drivers using the highways. As it is unreasonable to assume that every vehicle involved in these accidents was at fault these conditions probably were brought about by not more than 2 per cent of the drivers.

The essential facts are that, regardless of the speed at which travel moves at the present time, 98 per cent of the drivers operating vehicles on the highways were not involved in the accidents that resulted in fatalities or personal injury last year. On the face of this record it would seem absurd to use the wealth of the nation in building so-called foolproof highways. A much more logical approach to the problem would be to expend the proper amount of effort to keep the fools off of the highways.

The safety element has its economic aspects. No one will disagree that four-lane highways with traffic in opposite directions separated by medium strips or parkways, grades separated at intersections, and all other details embodied in the construction that makes for highway safety would be a nice thing to have and contribute immeasurably to the safety and pleasure of travel. However desirable they may be they are not possible except on a very limited mileage of our State highway systems. Our State highway systems comprise approximately 324,000 miles of highways that represent the principal routes of highway travel in the State. In 1932 less than 2000 miles of this total had been improved with four or more traffic lanes.

Assuming that it would be desirable to improve 5 per cent of the State highway mileage with four or more traffic lanes with opposing traffic separated, grades at intersecting highways separated, border roads to eliminate unrestricted access from abutting property, and sidewalks for pedestrian traffic where needed, the expense involved in this undertaking alone would amount to approximately four billion dollars.

When these figures are considered we must admit that in so far as we can visualize the future at this time from 95 to 97 per cent of the State highway mileage in this country may never progress in improvement beyond a two-lane highway. This has an important bearing on the safety aspect.

ALWAYS HUMAN ERROR

Engineering ingenuity can never entirely compensate for human error and the possibility of mechanical failure. There are definite economic and practical limitations to the highway's contribution to the safety of highway travel. Within these limitations there is no occasion to condemn the highway engineer or the highway for accidents or fatalities that result from improper or careless usage. The problem of the highway engineer is to strike a balance between what is wholly desirable from the standpoint of safety and convenience and what can be accomplished with the means at his disposal. Experience has demonstrated conclusively that we can not expect traffic to fit the roads. The roads must be designed to carry the traffic.

The obligation of the public with respect to motor vehicle transportation can never extend beyond providing roadways that may be used with safety by the reasonably careful driver. A highway that can be traveled with safety by the reasonably careful driver will be designed for the speed which observation of the general trend indicates will be the average for the greater percentage of highway traffic in the years ahead.

(Continued on page 36)

Beautification of Highways Inducement to Tourist Travel

By MRS. FRANK W. SORELL
Chairman, Texas Citizens' Highway Beautification Organization

THERE is an increasing desire on the part of the traveling public for more beautiful, comfortable, and interesting highways over which to travel. There is a matching desire of the citizens of all states to hear the tourists say who pass their way—"It has been a pleasure to travel through your beautiful state."

To reach that standard of beauty and comfort expected by the traveler of today, a state needs an organization of its citizens to cooperate with the state highway officials and be under their guidance. The state highway departments of many states are landscaping and keeping neat the highway rights of way but this limited beautification alone does not make a beautiful state, for the highway department's authority ends with the city entrance and the private property line facing the rights-of-way.

A traveler does not keep his eye focused constantly on the roadway. His gaze wanders out to a distance of say 300 yards on either side. He is traveling for pleasure. Although the right of way may be beautiful, he finds himself being irritated by the unsightly things he sees in the distance. Here is where a big field for educational work by the citizens' organization with the private property owner in regard to highway beautification is of value. All state highway departments are organized on a somewhat similar plan.

CITIZENS' ORGANIZATION

At the request of the Texas State Highway Department, the citizens formed an organization and have been working in coordination with the Department for three years. The highway officials appointed a state chairman, whose duty it was to form a citizens' organization for roadside beautification and improvement. In



MRS. FRANK W. SORELL

starting this movement it was very noticeable that the women were already beauty conscious and attached much importance to roadside beauty. Allowing for a few exceptions, the men thought only of the construction of more miles of good roadbed. It is amazing, the change in viewpoint of the men since they have seen demonstrated what the beautification organization has done for the roads. Now many men are numbered among our most enthusiastic members.

The first thing I learned was that this work meant much more than rushing in and planting trees and shrubs and sowing flower seeds. Time was taken to study the type plan of organization used by the Texas State Highway Department. The same method of organization was used by the citizens so that the two organizations function smoothly together.

Texas is divided into twenty-five highway divisions, with a division engineer centrally located in each division. The state chairman appointed a woman division chairman in each of these twenty-five divisions, living in the same town with the division engineer, women being chosen as they usually have more time to give to civic work than men. The division chairmen are chosen for their ability as leaders and organizers.

DUTIES OF DIVISION CHAIRMEN

Immediately upon her appointment, this division chairman appoints a county chairman in each county seat and takes up the work of organizing the counties in her division into a working unit. It is her duty to keep in touch with her county units and report all progress and assistance required to her division engineer, or, if further help is needed, to report it to the state chairman, who will take the problem up with the State Landscape Architect or State Highway Engineer. A division chairman appoints county chairmen or renews appointments in each county in her division in May of each fiscal year.

DUTIES OF COUNTY CHAIRMEN

On the county chairmen falls a large mantle of work, for they form the county organizations and arouse the interest of all county citizens in the movement to make their county an outstandingly beautiful unit of the state's plan for roadside improvement. They seek members from men's luncheon clubs, all women's clubs, chambers of commerce, county officials, county farm and home demonstrating agents, and rural property owners living adjacent to the state highways, and city resident owners whose property touches the street that is used as the highway route through their city.

The county chairmen call the citizens together and form the organization by electing all other officers that

are needed for a perfected organization. Then county chairmen appoint vice chairmen in all the towns in the county that touch a state highway. If this method is systematically carried out by each county chairman there will not be a community in the entire state that will not receive information in regard to the movement to improve every mile of roadside adjacent to a state highway. To sustain interest, meetings of the county organization are called on a designated day of each month, where the definite achievements and new plans are discussed. Reports are sent to the division chairman, who, in turn, sends to her division engineer and state chairman reports of all her county chairmen. In this way, the state highway officials are kept in constant touch with the work accomplished by the 254 counties in the state.

LANDSCAPE ARCHITECT IN CHARGE

The State Landscape Architect fills an important need in the organization. While all citizens' clubs and private citizens are encouraged to participate in this work, the Landscape Architect sees to it that they do not interlap in their work. He sees that their plans are artistic and practical, and that all rules for safety are followed out in accordance with his plan for the entire state.

Once a year the State Highway Engineer calls a group meeting of all the division engineers, division chairmen, and county chairmen together with the state chairman and State Landscape Architect where the work and needs of the organization as a whole are discussed. Each county group must use its own initiative in taking care of the individual needs of its county. There are several committees, however, that are recommended by the state chairman for the use of all counties. After the discussion of each of these necessary committees there are some slides to be shown that will help to demonstrate some of the improvements that have been accomplished in Texas by the committees. Outstanding among them is the one portraying what a poor rural family accomplished in making the surroundings of their home beautiful with personal work and the expenditure of the small amount of $3.90 in cash.

Some of these general committees carried on by the local highway representatives and citizens' chairmen are as follows:

WAYSIDE PARKS

This committee secures as many small wayside park sites as are needed by the department in its county and has the land deeded to the state. These park sites vary in size from a half to three acres. They must be woodland or otherwise beautiful spots that are adjacent to the highway. After the land is deeded to the state, the division engineer turns the park into the highway. From then on the parks are the State Highway Department's care. They are cleared of underbrush and sodded, and masonry entrances and drives are constructed. For those who care for out-door cooking and eating, concrete benches, tables and fire places are built. Scattered over the state are 500 such parks that are a joy to those who wish to draw out of the moving traffic for a short rest or to enjoy a picnic. The National Youth Administration participated in the improvement of 123 of these parks. The rest were built by the state's regular maintenance forces. One thousand such parks are the goal the department has set for Texas.

PRIVATE PROPERTY ENTRANCES

This committee encourages all property owners with entrances into the state highways to plant around their entrances, shrubs and trees, and if possible to build artistic gateways of rock and native wood and in this way help to beautify the highways. A note of interest is given when people place the name of their home on the gateway.

REMOVAL OF SIGNBOARDS

This committee tries to get the property owners adjacent to the highway right of way to remove all signs on their property and to be particularly careful to remove all signs that have been nailed on the trees as these are a menace to the health of the tree. The committee also tries to keep as many signs as possible from city entrances by appealing to the merchants not to use the signboard as a medium of advertising.

BEAUTIFUL CITY ENTRANCES

The planting of trees, blooming shrubs, and evergreens indigenous to the county help to make the city entrance attractive. A number of cities have added ornamental rock work and pillars, also, giving the entrances the name of some historic person.

BEAUTIFICATION AROUND PUBLIC BUILDINGS

This committee encourages the idea of beautification and improvement around all public buildings such as the court house, post office, churches and public schools. The chairmen of these county committees working with the chairman of school boards, county judges and commissioners, are showing outstanding improvement in the landscaping surroundings of public school buildings and court houses.

COMMITTEE ON CONTESTS

The State Highway Department cooperated with the citizens this year by having three contests. In each county an attractively decorated plaque was awarded to the most attractive gasoline station located on a state highway; a similar award was made for a public school that had its entrance on a state highway; and an award was made to a private property owner living adjacent to a state highway whose home came up to the highest standard of neatness, landscaping and general arrangement. The citizens' group handled these contests.

BEAUTIFICATION AROUND RURAL HOMES

This committee encourages the home owner to keep the land between his home and the highway clean, to remove all unsightly utility places to the rear of his home and if this is impossible, then to screen them from view of the traveling public with evergreens.

GASOLINE STATIONS COMMITTEE

This committee encourages all gasoline stations to be neat, to remove all unsightly posters littering up the stations, to keep sanitary restrooms, to use native shrubs as much as possible in landscaping around their stations, and to keep them in general good repair.

The mail boxes that heretofore have been unsightly because they were nailed to various types and sizes of posts are now being standardized by the State Highway Department. The boxes are being placed on a regulation removable 4x4 pine pedestal placed in a concrete base. The department paints the boxes and pedestals.

"Say, porter, did you find a big roll of money under my pillow?"

"Yessuh. I did, suh, and I thanks you, suh, very much, suh."

Divided Roadway Design for Multiple Lane Highways

By FRED J. GRUMM

Engineer Surveys and Plans, California Division of Highways

THE divided roadway is a method of defining in a manner satisfactory for prevailing speeds and characteristics the paths on which vehicles traveling in opposite directions may operate without conflict. It is not a recent innovation. Excellent examples constructed years ago are to be found in many parts of our country.

The relatively small volume of traffic and lower rates of speed in the earlier days of highway development hardly, if at all, justified the additional cost of this refinement. We were still struggling with the problem of getting the traffic "out of the mud." Two-lane roads, well surfaced or paved, were the adequate solution for so nearly every case that the few multiple lane roads were really curiosities.

The 15- or 16-foot pavements, with invisible center line outlived their capacity and usefulness when the marginal and central latitude for two 6-foot vehicles was pinched by increased speed of operation. Wider trucks hastened the obsolescence.

CAME THE TRAFFIC STRIPE

Then followed the almost universal designation of 10-foot traffic lanes, at first depending on the unmarked neutral central area and then having the division outlined or defined by the traffic stripe. The longitudinal construction joint in the cement concrete pavement served a like purpose. Addition of wider shoulders, adequately treated, induced the motorist, for a time at least, to ply closer to his respective edge of the road and away from the more serious source of interference.

Designs so constructed, marked and signed were and, for most of our highway mileage, still are very efficient. If used under normal expectation of reasonable care on the part of the traveling public, it is doubtful that separation of traffic by further division raises the efficiency rating.



FRED J. GRUMM

Most of our State highway mileage has and probably always will have a two-lane standard with shoulder width and border treatment consistent with the amount of traffic or with the zones of curvatures that indicate rational speed. On a large mileage of our roads, volume of traffic will not justify, for indefinite period, more than a two-lane standard.

Although a two-lane standard is the minimum required or constructed on practically all of this mileage, much of it carries a traffic volume that earns less in gasoline tax than the cost of construction and maintenance.

Continued improvement of greater mileage of these secondary roads, landscaping, grade separation, wider right of way, relocation, etc., eating up the earnings of the more heavily traveled multilane roads, do not permit us to go to a divided road design where only a two-lane capacity is justified. Moreover, dividing two lanes by a separating strip, without going to a four-lane standard would probably lead to additional hazard because, since the separation must be on a level crown to allow for passing, traffic would use it carelessly for a passing lane.

This leads to the conclusion that the principle of divided roadways should be applied only for more than two-lane traffic. Relief from hazard on the two-lane road may come from widening of the lanes, however, not to the extent of inviting risk of three-lane use. Also by proper shoulder treatment.

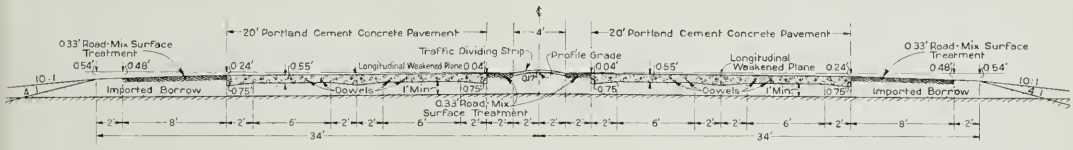
THREE-LANE HIGHWAYS

Where traffic volume requires we have been building a divided two-lane road. But instead of being so called it has been termed a three-lane roadway—and incidentally some other unpleasant and misleading names. This design depends on a central width safe for passing which means that it be at least 10 feet wide. It does not admit of interior curbs or appreciable roll in crown for the central strip.

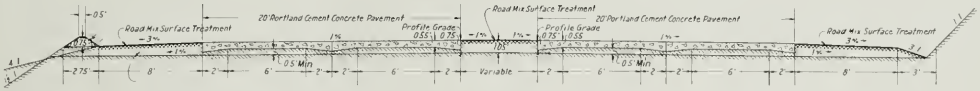
Unnecessary deviation from the outer lanes is discouraged by striping. Additional encouragement for the driver to stay within his lane can be provided by special design such as variation in type of surface. For instance with two outer lanes constructed of Portland cement concrete and the central lane of bituminous type or asphalt concrete:



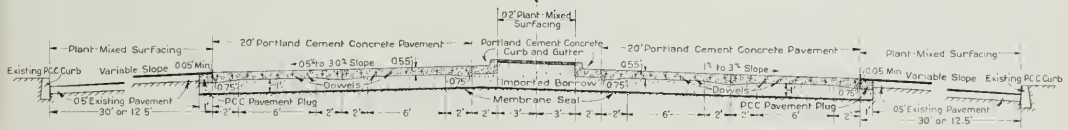
This view of section of East Bay approach to San Francisco-Oakland Bay Bridge shows one type of divided highway where a central raised strip is used for illumination standards.



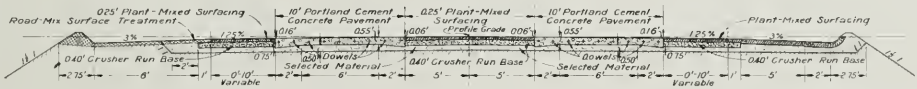
Typical cross section plan of divided roadway with raised dividing strip.



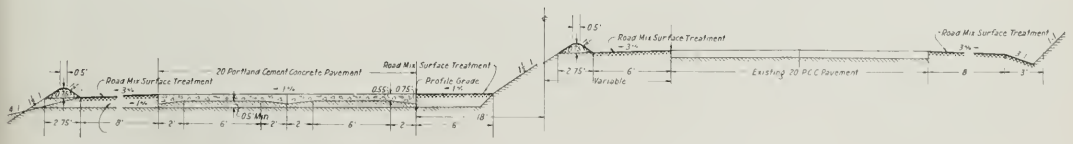
Typical cross section plan of divided roadway with 6 feet to 10 feet separation.



Typical cross section plan of divided roadway with raised dividing strip and curbs used where light standards are installed.



Three-lane roadway with variation in surfacing of lanes. Convertible into divided 4-lane roadway by addition of lanes and conversion of center lane into separation strip.



Typical cross section plan of divided roadway with roads at different levels.

1. There is a contrast in surface that plainly outlines individual lanes;

2. The rougher surface of the dividing lane reduces traffic to keep on or return to the hard, smooth outer lane;

3. A strong, smooth pavement is furnished in the two outside lanes where the slower moving trucks normally travel and impose the greater stresses;

4. The lighter type of surface is placed at a saving in cost where smaller wear and less frequent loads occur;

5. The design is adaptable to future expansion into a divided multiple lane highway by additional outer lanes at which time or subsequently the central strip can be revised into a separation by planting or otherwise.

THREE-LANE TRANSITIONS

In the progressive steps of expanding our State highways to adequately serve increasing traffic volume, the three-lane pavement or surfacing widths, as transitions between two and four-lane capacity roads are well serving an economic measure. Their efficiency has been demonstrated particularly under peak loads and where at times unequal volumes of traffic pass in opposite directions. It has been frequently observed how quickly the congestion on a two-lane pavement completely disappears when traffic passes onto the three-lane section.

The actual hazard of vehicles contending for the central lane has been overrated, as the three-lane roads, when constructed as they should be, are safe where ample sight distance is available and where an adequate shoulder width and treatment can be provided.

We find in California reports for the first half of the 1936 calendar year, for instance, that the percentage of accidents per vehicle mile of traffic is almost the same whether for two, three or four-lane roads. Omitting accidents that involved only single vehicles, or about one-third of all accidents reported and, which by their nature have little bearing on this relation of roadway widths, we find that, where two or more vehicles are involved, "approaching accidents" are very little more frequent than "overtaking accidents" on three-lane roads although considerably in excess on two-lane roads.

FAVORABLE ACCIDENT PERCENTAGES

This evidence is contrary to the impression that on the three-lane road, contention for the central lane is the one great source of trouble. Still further reflecting a relatively consistent performance on three-lane roads, the records show the three-lane roads compare favorably with the two-lane roads in the percentage of accidents involving two or more vehicles caused by vehicles turning from the same road and by vehicles conflicting from intersecting roads. The percentages of these kinds of accidents are higher on four-lane roads than on either three-lane or two-lane roads.

I want to stress the importance of a practice or policy embodying this progressive type of expansion in capacity of our highways, when increasing traffic volume demands greater service than is afforded by the two-lane road, few states have the available revenues—we have not in California—to jump from the two-lane road to divided four-lane construction long before the traffic volume requiring that capacity is reached, especially when this condition is presented in many instances.

ECONOMY IN ADAPTATION

We are presented with the situation of having to adapt or bring to a more adequate state of improvement highway systems composed, in the vast majority, of roads already existing and partially improved; of making these roads serve the purpose by revision of grade or alignment when necessary, by widening and by the addition of refinements that produce safety and comfort of travel. In but the smallest fraction of cases are we building entirely new roads. To accomplish this task properly and economically seems to me the most important phase of the problem.

Dealing with roads of four or more lanes the possibilities for variety of design are greater and conditions are presented for closer application of highway economies. Each problem must be approached on its own merits but for purposes of discussion we may consider divided multiple roadways:

1. As in reconstruction adaptable to existing pavements;

2. As in new pavement construction.

In each case character of improvement is influenced or determined by conditions presented in three locations:

(a) An open rural highway; (b) an immediate urban approach; (c) an avenue within a developed municipality.

Under the first class: Adapting existing roadways to divided four-lane or multiple lane roadway, we may enumerate a number of cases:

INTERMEDIATE TYPE SURFACE

Case 1. Two-lane roadway with intermediate type of surface. Perhaps an unusual situation since traffic volume would ordinarily require a higher type of pavement, but which might occur when utilizing a secondary road for new primary routing. Solution is more or less simple. Lends itself readily to progressive step construction.

Case 2. Two-lane roadway with high type pavement. Probably the predominant case. Several methods present themselves for consideration:

(a) Construction of dividing strip and two additional lanes all on one side if not limited by right of way considerations.

(b) Destroying or covering all or part of one lane for dividing strip and building one new lane on one side and two on the other, or equal additional width on each side.

(c) Jacking lanes apart if Portland cement concrete and of design practicable to that method. (Thickened edge section presents difficulty.)

ON DIFFERENT GRADES

(d) Building a separate two-lane roadway adjacent to existing road but even on different grades, brought together frequently enough for crossovers.

(e) Converting by progressive construction first into three-lane and later to four-lane type by adding in the first step additional width required for dividing strip. Most easily accomplished when resurfacing is indicated.

Case 3. Three-lane roadway with intermediate type of surfacing. Again perhaps an unusual condition.

Case 4. Three-lane roadway with high type pavement. This presents again the more usually encountered condition and a greater loss of original investment to provide for conversion to the divided four-lane design. These roads where naturally constructed with intention of adding a fourth lane, are usually deeentered as to right of way on this account.

An exeeption is where the central

(Continued on page 38)

Forty-four States Represented at Highway Convention

(Continued from page 21)

with the transition from two to three, three to four, four to five or six lane roads.*

Subjects discussed by the Road Construction Group covered a wide range and included bituminous treatments on the basis of local materials, compaction of fills, specifications for concrete pavements and specifications for bituminous-filled brick pavements. E. C. Lawton, Chairman, Commission on Road Construction, New York, presided, and among the speakers were H. C. Coons, Michigan; E. M. Turner, Construction Engineer, Tennessee, and C. M. Hathaway, Illinois.

Leading off with a talk by T. H. Dennis, Maintenance Engineer, California Division of Highways, on the subject: "Maintenance of Detours on Construction Projects Under Heavy Traffic,"** the Maintenance Group discussed such topics as winter maintenance of slippery pavements, relation of maintenance cost caused by climatic conditions and that caused by traffic, maintenance of roadside trees and shrubs and repair and maintenance of plain and reflector signs.

The sessions of this group were presided over by R. H. Baldock, Oregon State Highway Engineer, and among the speakers were G. H. Delano, Massachusetts; J. B. Early, Texas, and J. N. Bishop, Oregon.

The general and main topic of the Roadside Planting and Development Group, conducted by John L. Wright, Connecticut, had to do with means of reducing the maintenance cost of improved roadside areas.

TALK ON PLANNING SURVEYS

Governor Philip F. La Follette of Wisconsin was scheduled to deliver an address at Tuesday afternoon's general session on "The Financing of Public Works," but was unable to attend the convention. The delegates listened to an enlightening talk by H. S. Fairbank, Chief, Division of Information, U. S. Bureau of Public Roads, on the subject: "State-wide Highway Planning Surveys."

With Vice President L. V. Murrow of Washington in the chair, the general session of Wednesday morning proved an interesting one due to addresses by three outstanding authorities on "Highway Safety."

R. E. Toms, Chief, Division of Design, U. S. Bureau of Public Roads, Washington, D. C., treated the subject from the angle of "Properly Designed and Constructed Highways."*

AUTO INDUSTRY REPRESENTED

D. G. Roos, South Bend, Indiana, Technical Advisor to the Studebaker Corporation, and former president of the Society of Automotive Engineers, read a paper jointly prepared by himself and Paul G. Hoffman, president of Studebaker Corporation, addressing himself to "The Construction and Supervision of the Motor Vehicles Which Use the Highways."**

As Director, Public Safety Division, National Safety Council, Chicago, Sidney J. Williams devoted himself to the subject: "Responsibility of and Control Over the Driver on the Highways."

At the conclusion of the addresses, the Standing Committees of the Association, of which there are fifteen, went into executive sessions.

Meanwhile, many of the ladies attending the convention enjoyed seeing San Francisco, the city's two great bridges, the site of the 1938 Exposition and other points of interest from the air. As guests of the Division of Highways, as many of the wives of delegates as desired were taken on aeroplane trips from Mills Field beginning at 9.30 Wednesday morning. They were taken to the field from the St. Francis Hotel in convention automobiles and returned in time for lunch.

VISIT BAY BRIDGE

All in all, Wednesday was a very active day for both delegates and their ladies. Leaving the St. Francis at 1.30 p.m., the visitors were taken in automobiles across the San Francisco-Oakland Bay Bridge to the University of California campus, where they stopped for ten minutes; were then driven through Oakland, back across the bridge to the San Francisco Embarcadero, thence along San Francisco's famous waterfront to the Marina and through the Presidio, one of the most charming of scenic trips of which the city by the Golden Gate boasts. The sightseers were returned to their hotels at 5 o'clock in time to prepare for the dinner tendered them in the St Francis Hotel by the State Division of Highways.

From an entertainment point of view, the dinner was the highlight of the convention.

The Colonial and Italian banquet rooms of the St. Francis proved inadequate to hold the hundreds of guests at the banquet and Parlors A and B on the mezzanine floor were utilized to accommodate the overflow. The dinner attendance was the largest in the history of the hotel.

BANQUET GAY AFFAIR

Leo Carrillo, noted Hollywood movie actor and Native Son was master of ceremonies and Miss Jean Parker, M. G. M. screen star, was guest of honor.

At the conclusion of the dinner, tables were cleared out of the two large banquet halls and the guests were seated for the entertainment to come. To Director Earl Lee Kelly of the Department of Public Works fell the pleasant duty of introducing the prominent guests at the speaker's table and Master of Ceremonies Carillo.

Only one speech was permitted and the honor of making that was delegated to Governor Frank F. Merriam.

The Governor was in high good humor and his facetious remarks, interspersed with serious description of the glories of California and the magnitudinal accomplishments in road building and bridge construction of the Division of Highways, made an outstanding contribution to the evening's program.

Under the infectious direction of Leo Carillo the entertainment moved along in swing time and the singers, dancers and other artists who took part were repaid with generous applause for their contributions.

Two addresses featured the general session of Thursday morning. L. V. Murrow, Director of Highways, Washington, talked on "Interesting and Unusual Mountain Road Construction," and H. S. Mattimore,

(Continued on page 40)

* Paper read by Mr. Grumm appears on page 30.

** Remarks by Mr. Dennis appear on page 10.

** Mr. Roos' address begins on page 12.

Auto Manufacturers Interested in Highway Safety Campaigns

(Continued from page 12)

speed about fifteen miles per hour. The wildest visionary could not have foreseen that 28 years later there would be 27,000,000 motor vehicles averaging 40 to 45 miles per hour, running up a yearly total of 200,000,000,000 car miles per year which, translated into terms of passenger miles, would be at least 400,000,000,000 passenger miles per year. In the light of these figures it is astonishing that accidents and fatalities are not more than they actually are when one considers this gigantic growth in both density and speed of traffi .

BETTER AND SAFER ROADS

In 1908, apart from a few miles of macadam, our roads were dirt, sand, and gravel. Since then, we have built nearly 1,000,000 miles of improved gravel and 200,000 miles of concrete and macadam. We have two lane, three lane, four lane, and six lane highways. Yet, as spectacular as the development has been, we are face to face, in our opinion, with the need of even more spectacular development than we have had since 1908. We need more highways, and we need better highways and safer highways. We have mutually a difficult problem in education and control of our 40,000,000 motor vehicle operators. We have mutually a problem in building safer motor vehicles.

Manufacturers have been accused of building cars and trucks that are too powerful, or too fast, for general use. What we manufacturers have done in the interest of safety I propose to tell you. What more can still be done is a matter for collaboration and discussion.

Let us point out that we must design and build to meet public demand or else go out of business. The public wants power and performance. They will reject and refuse to buy a product which is retrogressive as regards any of the fundamentals of performance no matter what attributes the vehicle may have. That safety is and always has been a vital consideration in motor car design I propose to touch on now.

Although human progress in mechanical arts moves at a very rapid pace today, progress is made by such gradual increments that we rapidly accept improvements and incorporate them in our daily economy, losing completely consciousness of the gains made until we stop and momentarily look back, making comparisons between "then" and "now."

From the very beginning the first pioneer builders and designers of motor vehicles have had the importance of designing safety into their vehicles drilled into them by grim necessity. For no sooner had they succeeded in getting a motor vehicle designed and built, that would run with a fair degree of regularity than it became the target for the distrust and animosity of every lover of horse flesh and every competing form of transportation and for ridicule on the part of the general public.

Resolution No. 6

Federal Trust Funds

WHEREAS, On regular Federal Aid highway projects it is the custom to advance the Federal share and to secure reimbursement; and

WHEREAS, This method of payment takes up for a time State funds that otherwise might be used to provide additional construction; and

WHEREAS, This method does not permit the fullest use of available State funds; now therefore

BE IT RESOLVED, That this Association recommend to the Congress that an amendment be passed to the Federal Highway Act that will permit advancing regular Federal Aid funds as has been done with National Industrial Recovery highway funds in establishing the Trust Account revolving funds.

ENGINEERING PROBLEMS

And it may be noted here that the first vehicles built were dangerous. Mechanical failures were frequent. Brakes were brakes in name only. Fire hazard and explosion hazard was a thing to be reckoned with. Steering was poor, the entire problem being but little understood. Performance consisted in merely getting the vehicle to go somehow, but to go. The passengers had little or no comfort or protection from the weather. A journey of 100 miles was a fatiguing adventure, but having all the thrills of a voyage of discovery.

You see, therefore, that the automotive engineer was before the bar of opinion to demonstrate that the motor car could be made a safe means of transportation. The problem was a difficult one because outside of the question of safety, so many other engineering problems arose in connection with the vehicle itself to make it perform reliably and satisfactorily.

When the motor car industry got under way at the beginning of the century, alloy steels were little known and little used except in ordnance. The demands for better steels required for automotive equipment stimulated the science of metallurgy, in fact, subsidized and created it with the result that one new alloy steel after another was invented. Heat treatments perfected and the physical properties of steels and their resistance to fatigue multiplied by 2½ and even 3. Today the largest consumers of alloy steels are the motor vehicle manufacturers.

MECHANICAL FAILURES FEW

The tonnage of alloy steel in relation to carbon steel is mounting steadily and invading other industries, particularly the railway and aviation industries. Today so perfect is the control of alloy steel manufacture, so high the quality of the steel and accurate the treatment, that mechanical failures due to defective material are but a minute percentage of the few mechanical failures that occur.

Perhaps in no one single item has more progress been made in the direction of safe motor cars than in body design and construction. Those of you who can remember the motor car of, say, 1904, can recall an open car with the passengers perched on the top, back to back, or in a tonneau with a door on the back, out of which occasionally an incautious passenger fell.

The windshield, when there was one, flimsily attached to the dash, the



Official welcome at Mills Field for distinguished guests of American Association of State Highway Officials. Left to right: Leo Carrillo, noted movie actor, who was master of ceremonies at annual banquet of Association; Earl Gilmore, president of Gilmore Oil Co.; Jean Parker, Hollywood star, who was guest of honor; Earl Lee Kelly, Director of Public Works; Justus F. Craemer, Assistant Director of Public Works.

structure of wood glued and screwed together and covered with aluminum or, if it happened to be a sedan, a body high in the air, unstable and with no inherent structural strength, which broke open like a strawberry box in event of a crash; baggage piled on the top of the roof, careening along the road like a ship in a gale.

The wooden structure entailed heavy hinge and door pillars, as well as thick windshield pillars, which resulted in bad visibility and blind spots. Huge windows and windshields of plate glass added to the hazard of an accident. Today, the all-steel automobile body is to safe travel in the automobile what the steel pullman and steel passenger coach is to safety in railway travel. Not only is the structure of the body lighter and stronger, but it no longer is considered separate from the chassis and contributes enormously to the strength of the combined assembly of body and chassis. Its ability to resist impact, to bend, or yield with high resistance and not break up is a real safeguard in an accident. Steel permits narrower door posts and hinge pillars, as well as windshield pillars, and hence gives better vision.

To further improve vision, the windshield wiper was developed, first hand operated, and then power operated, and now the defroster is offered to eliminate the very dangerous effects of frosted or clouded windshields. Only a few years ago we had to drive with open windshields in a storm if we wished to see.

The open car has almost disappeared, and with it the hazard due to rolling over, which very often was fatal. The all steel closed body makes such an accident a very minor hazard.

Instrument boards are more legible and the controls placed near at hand so they can be operated easily without taking ones eyes off the road.

It would be impossible to properly evaluate the reduction in mortality and serious injury due to the perfection and use of safety glass. The manufacturers of safety glass have accomplished marvels in the improvement of its shatter resisting qualities under wide temperature ranges and under different types of impact. The cost of adding this feature of safety to the motor car has been high and the public has been reluctant to allow the manufacturers to pass this cost on, even though its benefits are so obvious. Here legislation has helped the manufacturers by making its use compulsory and the increased volume of production of this glass has enabled its producers to lower costs.

Ventilation has been improved and the body sealed against fumes, both in the interests of hygiene and protection from toxic gases which affect a driver's reactions.

ELECTRIC STARTING

We, many of us, remember the days when we had to start an automobile engine with a crank. Many a broken arm or worse occurred from a backfire. The electric starter definitely removed this hazard. Strangely enough, in spite of its high cost, its appeal to the public was more as a labor saving device and a surer means of starting the engine than from its greater safety. With it went the old acetylene head lamps and oil side lamps and in their place came the generator and storage battery and electric light. Head lamps have been improved and a great amount of work done on the study of adequate illumination versus head light glare.

If we could obtain a car of the vintage of 1904 or even 1915 and compare its steering with that of the car of today, I believe most of us would

(Continued on page 40)

Highway Has Its Limitations in Contributing to Safety

(Continued from page 27)

It will have traffic lanes wide enough for ample clearance at the speed for which it is designed. It will have shoulders wide enough for stopping, no deep side ditches, a consistently smooth nonskid surface, and an alignment, profile and cross section which at no place will confront the traveler with the unexpected or slow traffic to such an extent that the impatient driver is encouraged to take unnecessary risks.

When highway traffic moves at high speed greater clearance between the vehicles is required for safety. There is also a greater reluctance of drivers to travel near the edge of the pavement, particularly if the shoulders of the road are soft. The clearance provided for two-lane highways should be ample for two traffic lanes, but not enough to invite the possibility of its use as a three-lane road. For this purpose a 22-foot paved roadway width is indicated.

We have failed in many instances to provide highways in which all component parts of the highway structure are safe for travel at the prevailing or design speed. The inclusion of short sections of highway in which the design as to curvature, sight distance or other details falls below the general standard of the road constitutes a very serious fault because at these places the driver encounters the unexpected, particularly at night.

We have failed in many more instances to provide highways on which overtaken vehicles may be passed with safety. The design standards of this association with respect to sight distance are in need of a thorough overhauling. They are in effect nonpassing minimums which do no more than allow a vehicle, traveling at high speed, to be brought under control and stopped to avoid contact with a stationary object in the roadway ahead.

A safe passing sight distance is a function of the speed of the passing vehicle, the overtaken vehicle and the speed of a vehicle approaching from the opposite direction. If the differential in speed between the passing and the overtaken vehicle is large, the safe passing distance is much less than when this differential is small. It increases if more than one vehicle is to be passed. We must revise our conception of sight distance if we are to provide highways on which overtaken vehicles may be passed with safety. There has been but little conscious effort on the part of highway designers to consider this phase of highway design. We have been more or less content to be satisfied with an 800 foot sight distance.

SOME RECOMMENDATIONS

The sight distance required for three-lane construction should not be less than the minimum safe passing sight distance for two-lane construction. For relatively high road speeds, therefore, this sight distance is exceedingly large and difficult to obtain except in very easy topography. Where restricted sight distance is encountered at only a few places, added safety may be obtained by providing four traffic lanes at such locations. If these locations occur at frequent intervals, the obvious thing to do is to provide four traffic lanes at once.

A three-lane road with inadequate sight distance in effect becomes nothing more than a wide two-lane road, except for the relatively small percentage of drivers who have no compunction about taking unnecessary risks.

Where traffic is congested on two-lane highways every effort should be made to expand the facilities into a four-lane highway with traffic in opposite directions separated by a neutral strip or parkway. A neutral or median strip 3½ to 4 feet in width and constructed of contrasting color or material flush with the roadway surface of the traffic lanes serves the same purpose as a wide center line marker and to this extent encourages and makes possible a greater width of separation or clearance between opposing lines of traffic. The hazard of head-on collisions, however, is not eliminated because there is common surface in the center of the highway that is accessible and can be used easily by impatient drivers in the traffic streams moving in opposite directions.

In addition to practically eliminating head-on collisions with opposing traffic, the four-lane highway with traffic in opposite directions separated by a parkway may be designed to decrease the hazards at intersections. On heavily traveled four-lane roads it is almost impossible to obtain a sufficient break in traffic going in the two directions to permit cross movement of vehicles without extreme danger unless traffic control lights are used. If the roadways are separated a sufficient width to provide a safety island between the lanes of opposing traffic, cross movement may be effected in two operations.

The fact that considerably more than one-half of the fatal motor vehicle accidents occur during the hours of dusk and darkness, although traffic during these periods probably is not over one-fourth of the 24-hour total, is evidence of the fact that the speed of the motor vehicle has increased beyond the range of its headlights.

We must begin to consider whether the expense of lighting some of our highways would not be justified wholly from the standpoint of safety of operation. By no stretch of the imagination is it possible to visualize rural highway lighting on any but a small percentage of our principal State highways. While the cost of installing highway lighting is not excessive, the annual cost of operation in many cases would entail a charge equal to or greater than all other maintenance items of the highway.

PEDESTRIANS CARELESS

A heavily traveled highway is not a safe place for the pedestrian. Collisions between motor vehicles and pedestrians accounted for 35 per cent of the highway fatalities in 1935 in rural areas and cities of less than 10,000 population. This points definitely to sidewalk or footpath construction as an adjunct of highway design.

The highway engineer's contribution to highway safety consists essentially of omitting no detail of design within economic limitations that makes for the safety of travel. This guiding principle will provide highways that can be used by the reasonably careful driver with safety—highways on which overtaken vehicles may be passed with safety, and highways on which the driver is confronted with no conditions that constitute a hazard without ample notice or warning of such conditions. When this has been accomplished, the highway will occupy its proper place in supporting the safety triangle. Beyond this safety must rest with the individual.

Resolution No. 7

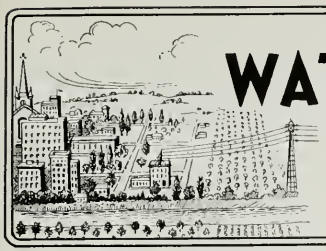
Central America Cooperation

WHEREAS, An appropriation made by Congress for cooperation with the Governments of Central America has disclosed the fact that those countries are willing and able to cooperate in bridge and road construction; and

WHEREAS, Such appropriations when expended as heretofore largely for products of American heavy industries produce the threefold advantage of providing orders to American mills and supply houses, increasing exports and at the same time expressing in tangible and valuable form the good will of the United States toward the nations cooperating; now therefore

BE IT RESOLVED, That the Association of State Highway Officials advocates the continuation of such appropriations on a scale which will continue to develop cooperation within the capacities of the several Central American Governments; and

BE IT ALSO RESOLVED, That the Association favors the further investigation of a route for an inter-American highway southward from Panama and recommends that Congress make further provision for such work.



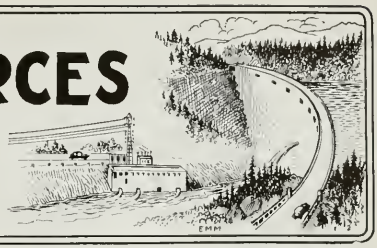
DIVISION OF WATER RESOURCES

OFFICIAL REPORT

FOR THE MONTH OF

November, 1936

EDWARD HYATT, State Engineer



Irrigation Districts

An application for investigation and approval of a bond issue in the amount of $700,000 has been filed with the Districts Securities Commission by Imperial Irrigation District. The directors of the district have approved the form of a contract offered by the Rural Electrification Administration and are planning the construction of transmission and distribution lines to serve rural areas. The district has recently completed construction of the first unit of a Diesel stand-by plant at Brawley which will be enlarged to serve other areas in the district pending the construction of hydro-electric plants along the line of the All-American Canal.

Economic studies of newly proposed irrigation districts on the line of the Friant-Kern Canal are now in progress. The water supply requirements of these areas, and their ability to pay the necessary costs of acquiring the same, will be determined from the present investigation of soils, crops and land valuations. A separate report will be rendered on each district and recommendations made as to changes in the boundaries proposed.

FLOOD CONTROL AND RECLAMATION

The three new drainage pumping plants in the Sutter By-pass are practically complete, and will be ready for operation when necessary. The War Department is doing some final finishing-up work, but the contract work has been completed and accepted.

Bank Protection Program

Excellent progress has been made by the War Department on the construction of bank protection works on the Sacramento River under the State-Federal cooperative program of June, 1932. At this time 24 project units have been approved to an estimated cost of $500,000 inclusive of levee set-backs and partial set-backs amounting to $95,000, which work is classed as new construction under the Sacramento flood control project.

Included in the approved units is 19,612 lineal feet of lumber mat under water protection and rock bank paving, with partial levee set backs approximately 11,587 feet in length. There is also included 6575 lineal feet of levee set-back without bank protection. Wave wash bank protection, consisting of a rock wall without pavement or set-back, is provided in four places, with a total length of 893 feet.

Work has been completed at the Colusa weir, Campbell-Dwyer ranch, Colusa Bridge, Hamilton Bend and Alaska Packers Association. Work is now under way at Steidlmeyer ranch, Cecil's Lake, Burke ranch, Edwards Break, Chickory Bend, Lisbon pump and Walnut Grove. Two complete plants are in operation and it is expected that the entire program will be completed.

Sacramento Flood Control Project

During this period the incidental right-of-way construction in connection with the new levees on the Sacramento River above Colusa has been practically completed, about 25 men having been engaged during the period on this work. The largest single job was the construction of a new pumping plant at the Keller ranch.

IV. WATER RIGHTS

Supervision of Appropriation of Water

Nineteen applications to appropriate water were received during the month of October, 14 were denied and 15 were approved. In the same period 13 permits were revoked.

On October 1st reports were requested from 1310 permittees and 571 of these reports were filed during the month. These reports are now under study with a view to determining the status of each project.

SACRAMENTO-SAN JOAQUIN WATER SUPERVISION

Due to lack of rainfall during the past month there has been no increase in the stages of the Sacramento and San Joaquin Rivers. The flow of the Sacramento River at Sacramento is about 5500 second feet.

The summer crops are all harvested and in some places winter irrigation of the orchards is under way. The degree of the salinity in the lower Delta and upper bays has not changed greatly during the past month. The number of stations for salinity sampling in the Delta have now been curtailed so that throughout the winter, sampling will be continued at the permanent stations only.

CALIFORNIA COOPERATIVE SNOW SURVEYS

The general storm that occurred during the closing days of October, brought an end to the extreme fire hazard existing throughout the mountains and permitted the Forest Service to cooperate in the establishment of many of the new snow courses previously planned for the coming winter. Engineers from this office working with the personnel of several of the national forests, selected, laid out and permanently marked new snow courses.

Stocking of the last of the shelter cabins has been completed. Snow measuring equipment, food, blankets, and wood have been placed in each cabin for the use of the snow surveyors, while in the mountains, during the dead of winter.

With all of the details and necessary preparatory work attended to, everything is now in readiness for the field work of the 1936-1937 snow season.

FEDERAL COOPERATION

Topographic Mapping

Progress was made in the topographic mapping of the Avenal Quadrangle in San Luis Obispo and Santa Barbara Counties and on the Downieville Quadrangle in Sierra and Plumas Counties during the month of October.

Stream Gaging

Water Supply Paper 791 of the United States Geological Survey is now available. This is a report of cooperative stream gaging in the Pacific Slope Basins in California for the year 1935 and contains rating tables for some of the more important gaging stations.

Central Valley Project

The United States Bureau of Reclamation continued work during the month on the preparation of plans necessary for starting construction on the initial units of the project. Preliminary investigations and exploration work have been continued at Kennett and Friant dam sites as has the survey along the Contra Costa Conduit and Friant-Kern Canal. Appraisers are working in the field evaluating lands and necessary rights of way to be acquired. The Division of Water Resources is conducting surveys and making investigations in the San Joaquin and Sacramento valleys preliminary to the acquisition of properties and water rights and the preparation of agreements necessary for the construction of the project.

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official journal of the Division of Highways of the Department of Public Works, State of California; published for the information of the members of the department and the citizens of California.

Editors of newspapers and others are privileged to use matter contained herein. Cuts will be gladly loaned upon request.

EARL LEE KELLY Director
JOHN W. HOWE Editor

Address communications to California Highways and Public Works, P. O. Box 1499, Sacramento, California.

Vol. 14 DECEMBER, 1936 No. 12

Divided Roadway Design for Multiple Lane Highways

(Continued from page 32)

lane has been purposely constructed of a type that can be conveniently converted into a dividing strip after its service has largely repaid its cost. With this exception the problem resolves itself into a question of how much of the pavement can be abandoned. As in Case 2, several methods are available.

LOSS OF PAVEMENT

Case 5. Four-lane roadway with high-type pavement. It is evident that in this case there will be a loss of pavement in amount equal to the determined width of the dividing strip. Practically all of the existing four-lane mileage is constructed of high-type pavement, much of which represents comparatively recent investment.

This class of road, except for the hazard ascribed to them for want of a dividing strip, will serve expected traffic for many years while funds are being used to provide adequate facilities elsewhere. The question arises immediately whether benefits derived from dividing these roads will be as great as the benefits, including safety, which could be provided at equal expenditure on roads elsewhere.

In all cases involving revision of the existing roadway to the divided multilane road there are features of construction other than replacement of pavement. They again require careful examination and contribute their share to the final determination of the problem. Physical limitations may react on the practicable adaptation of the old pavement to the new roadway design.

RIGHT OF WAY FACTORS

Right of way width will usually be a major item for consideration. Right of way usually has been acquired on the basis of providing for specific widths of roadway, shoulders, parking areas, drainage, trees or roadside development, poles, sidewalks and curbs. Many of these features are not readily susceptible to a revision of typical section without encroachment on areas planned for their use or for other purposes. This then leads to the alternative of acquisition of additional right of way taken from highly developed adjacent land.

Other numerous incidental losses and costs are encountered, such as: loss when expensive subgrade treatment was placed beneath pavement that will not be continued in use. Subgrade treatment will usually be adverse to planting contemplated within the dividing strip.

Gutter lines, curb lines and sidewalks may be disturbed. We have, for instance, constructed a considerable mileage of State highways to a 76-foot width with gutters and curbs installed. This is a six-lane pavement width with two parking lanes of eight-foot width each adjacent to the curbs and with adjacent property highly developed.

Bridges must be widened or rebuilt. Drainage structures corrected. Public utility facilities removed. Pipe lines may fall beneath pavement instead of in the open shoulder where they have previously been placed under permit.

DESTRUCTION OF PLANTINGS

Fences, poles, trees will be disturbed. Not the least of these are the trees or plantings. With the added interest taken by the public in recent years in roadside development, destruction of planting meets with even more serious opposition.

All of these complications together with the losses in previous investment and new project costs make the conversion into a divided multilane road of a highway not previously laid out with this ultimate design in view, a project often difficult to justify. Conditions must be particularly favorable or the function of the road must have changed unexpectedly.

Under normal conditions only selected sections need be considered for treatment with a nominal division strip. Under extraordinary circumstances the objective of new design overshadows all objections and the project approaches the character of a new undertaking.

We must in this consideration recognize the evidence of accident analysis which shows that dividing roadways can only minimize a relatively small percentage of accidents prevalent on four-lane roads unless the improvement includes other features, such as grade separations of both rail and road, pedestrian protection, embodiment of the free-way principle, side service roads and the like.

In itself the divided roadway cannot materially increase the four-lane capacity. It will probably induce

Resolution No. 8

Inter-American Highway

WHEREAS, It has been proposed to construct a motor highway along the Pacific slope of the Western Hemisphere from Fairbanks, Alaska, to Santiago, Chile, and thence to Buenos Aires; and,

WHEREAS, This proposed highway traverses twelve republics of Latin America, four states of the United States, British Columbia and the territories of Yukon and Alaska and will serve a contiguous territory of more than five million square miles in area and a population in excess of 63,000,000 people; and

WHEREAS, This projected highway traverses the potentially rich and populous west coast states of the Republic of Mexico and connects in the City of Mexico with the Inter-American Highway now completed from Laredo, Texas, to the City of Mexico; and

WHEREAS, It appears that this Pacific coast route will when completed greatly accelerate motor travel to Mexico and thereby give impetus to the southerly extension of the Inter-American Highway.

NOW THEREFORE BE IT RESOLVED, That this association does hereby endorse the Inter-American Highway together with its Pacific Coast extension to and into the Territory of Alaska and urges upon the Congress of the United States that it extend to the nations of Latin America and the Dominion of Canada the utmost of cooperation in the development of this international project.

greater speeds leading to new complications or increase of hazard of different character. For instance, if one or both sides of the divided roadway should be carrying a fairly heavy volume continuously, traffic would probably adjust itself to reasonably careful operation.

As soon as traffic lightens the play of excessive speed and passing occurs. It is then a question whether the dividing strip eliminating the 22 per cent of "approaching" accidents on our present undivided four-lane roads may not also induce an increase in the 38 per cent of "overtaking" accidents we now record.

Likewise there is doubt as to how much of the 19 per cent of accidents occurring in turning from the same road (left-hand turns mostly) on present four-lane roadways and the same percentage of accidents occurring at intersecting roads, will be cured by the dividing strip.

A dividing strip at least equal in width to the length of a car would probably prevent an increase of the intersecting road accidents if not contribute to a reduction in hazard.

DIVIDING STRIP WIDTH

The width and character of the dividing strip has an important part in this design. We are concerned more immediately with the minimum width. This, in my opinion, should probably be 4 feet. This minimum can hardly provide all of the benefits which the dividing strip seems to offer.

The elimination of approaching headlight glare for instance may be provided by shrubs or plants of proper height. The difficulty and hazard of maintaining such planting in a narrow strip would bar such treatment. Conversely the wider strip with planting leads to increased initial and maintenance costs. The narrower widths will probably be employed primarily in converting our existing pavements into divided roadways.

We favor the raised dividing strip or zone but until the problem has been more thoroughly studied we are constructing this raised division with an ogee curve design of temporary character, such as plant mix. Except where installations within the dividing strip require (such as light standards or similar structures), the vertical face curb is not encouraged. The sloping face or ogee curb design is probably the more acceptable type for permanent installation.

The separate problem of providing for drainage induced by the installation of a division strip, for instance where horizontal curvature requires superelevation will influence the design.

Again the location of the project with attendant varying conditions may dictate different design. I should say that on rural roads where few intersections or entrances of side roads prevail the simplest type of effective division and of reasonable width is likely to be preferable and more satisfactory than on a project in urban area.

The principle of dividing the roadway has been applied on our California highway system. We have constructed or under construction 65.3 miles of which 55 miles is four-lane divided roadway. Planned for early construction is 27 miles more of the latter type.

Specially designed three-lane roads readily convertible into four-lane divided roadway total 47 miles. We have plans for early construction of this type for 10 miles more. The longest stretch of divided four-lane road is 18 miles and is planned for construction early next year.

These roads include division widths from as little as 4 feet of arched strip to wider curbed designs and also to roadways entirely separated even as to grade. The design has been selected to best meet local conditions. They have been necessarily limited to type that would not jeopardize by cost our ability to consistently treat similar conditions in like manner.

NEW CONSTRUCTION POSSIBILITIES

Our studies are being extended into consideration of where new construction on our highways may permit the use of four-lane divided roadway. It is a foregone conclusion that we cannot adopt, with present limited revenues, a policy of supplying widths of pavement for in excess of widths adequate for present and near future volume. We feel justified in moderate application of division of roadway design in certain localities and our immediate efforts no doubt will be limited to such projects where new construction or reconstruction is contemplated.

In the advisory capacity to the public that pays the bill, the engineer should be inclined to council a conservative policy. There is no cause to regret that the progressive improvement of highways for the benefit of as many sections of the state as possible has proceeded on the basis of pay as you go and build as you can pay.

The value of the roads we have built up from a few pioneer trails to the many surfaced highways is expressed in the class and type of travel they have induced. We are not in the red, either in our accounting records or in the inventory value of our facilities. We can probably attain a more adequate status with current revenues if demands of the road users remain consistent with their contributions toward the requisite highway construction, maintenance and patrol.

Resolution No. 9

An Appreciation

WHEREAS, the Twenty-second Annual Meeting of the American Association of State Highway Officials at San Francisco, California, has been made extremely successful not only by the work of its own officers and members but by the sincere interest of His Excellency Frank F. Merriam, Governor of California; the careful, considerate planning of the Division of Highways of the Department of Public Works, State of California; the hospitality of the St. Francis Hotel; and other individuals and organizations; and

WHEREAS, Not only the delegates but also the many ladies who have been present at this meeting have so keenly enjoyed the very fine program of entertainment which has been arranged for them by these people;

THEREFORE, BE IT RESOLVED, That this Association expresses its sincere appreciation to His Excellency Frank F. Merriam, the Division of Highways of the Department of Public Works, the management of the St. Francis Hotel, and all other individuals or organizations who have contributed toward the success of this Convention.

Auto Manufacturers Interested in Highway Safety Campaigns

(Continued from page 35)

allege that someone had purposely "rigged" the older model. The columns whipped about, the steering gears themselves were in many cases reversible and the geometry of the steering connections so bad that "wheel fight" was terrific. Fortunately speeds were low so that the car could be managed, but the steering effort with reduction of 10 and 12 to 1 was prodigious and fatiguing.

Today, large steering wheels are made so that they will bend not break, with comfortable gripping sections and structures that absorb vibrations. Correct steering geometry, reductions in steering ratio of 18 or 20 to 1 with high efficiency steering gears makes steering well nigh effortless and control of direction easy. Self righting or directional trend gives the car "steering sense." The structure of the steering gear and connections has been improved so that mechanical failures are comparatively unknown, as all parts are protected against dirt and wear.

TIRE ADVANCE NOTABLE

To the tire manufacturer must go great credit for keeping pace with the ever growing demands made on them. In 1906 a complete tire repair kit, extra casings and tubes, and a complete knowledge of how to repair tires were part of the equipment of every motorist. The tire would have been a distinct hazard if speeds had been high but wheels were large and tires were small in section and speeds were low so it merely meant extra work when a blow out or puncture occurred. Today wheels are smaller, tire sections are larger for comfort and low center of gravity. Today the tire perfectly meets the demands. It is a hazard only when the operator is guilty of gross neglect by operating with inadequate inflation pressures or driving at high speed with worn out casings.

RIDING COMFORT

All cars ride reasonably well on a good road. It might be thought, therefore, that the riding problem and its attended problems were becoming easier for automotive engineers, but better roads have merely served to contrast how badly a car rode on bad roads and improved concrete highways have caused us to be deluged with a shower of complaints as to how we can eliminate the noise and attendant jar of car going over the joints in concrete highways. Riding comfort has a bearing on safety inasmuch as it affects fatigue and hence alertness of an operator.

Noise and vibration were both serious problems in very early cars. The wide use of open cars in the early days of the industry made this problem somewhat less acute as time went on, but the sudden rise in demand for closed cars brought this problem again, and more acutely, to the front. The growing use of steel bodies still further accentuated the problem. High frequency vibrations and droning noises have a distinct numbing effect, as well as fatiguing effect, on the human nervous system. The last two years have seen great progress made in subduing both noise and vibration until this year a new standard of excellence has been set but there must be further progress along these lines, especially on cars capable of high speeds.

In 1906, brakes can only be describe as "awful." They were exposed to mud, water, and dirt. They were undersized and capable of stopping a car from 30 miles an hour in 75 or 80 feet if in good condition. They had very poor life and needed constant adjustment. Today a car with four wheel brakes in good condition can stop in 35 feet from 30 miles an hour, in 41 feet if in fair condition, and in 60 feet if in poor condition.

WAGE SAFETY CAMPAIGN

The gasoline tank began its journey from the front of the car and under the front seat to the rear end of the car many years ago. It met with some stubborn resistance on the way but the interests of safety demanded that the fire hazard be removed. Hence the rear location which is universal on passenger cars and on the side locations which are used on trucks.

The interest of the automotive industry in the highway safety is not restricted to building safety into its vehicles. Safety activities have been carried on for years but during the past twelve months the industry has contributed to a safety campaign which is being carried on energetically among organizations with a total direct membership of over seven million. The American Automobile Association, the American Federation of Women's Clubs, Parent Teachers Associations, the American Legion, Farmers Grange, have enthusiastically enlisted for this war on accidents. They constitute a mighty force and you can count on their interest and full support for any campaign you inaugurate for protecting and expanding our highway system.

You have shown us your capacity for leadership by taking America out of the mud—now we ask even more—give America the safest highway system in the world.

44 States Are Represented at Highway Convention

(Continued from page 33).

Engineer of Tests, Pennsylvania, took as his subject "The Most Recent Developments in Highway Research."

Following these addresses, the convention went into a business session, receiving the reports of the executive committee, the treasurer, the auditing committee, committee on resolutions, nine of whose resolutions were adopted, the nominating committee and reports of standing committees.

Election and installation of new officers brought an end to the convention.

While the convention was winding up its affairs, the ladies were taken on a motor trip to interesting points in San Francisco, and were entertained at an informal tea in the Western Women's Club.

At 5 o'clock the beautiful color film, "California Highways," produced by the Division of Highways, was shown in the Italian Room, and at 8.45 Thursday night delegates and their wives were taken on a tour of Chinatown.

On Friday and Saturday two automobile caravan trips were offered to members of the association and their families. Starting Friday morning, transportation was furnished to delegates wishing to go home via Los Angeles with stops at the Big Trees, Del Monte and Santa Barbara, while another caravan took visitors over the Redwood Highway to Eureka.

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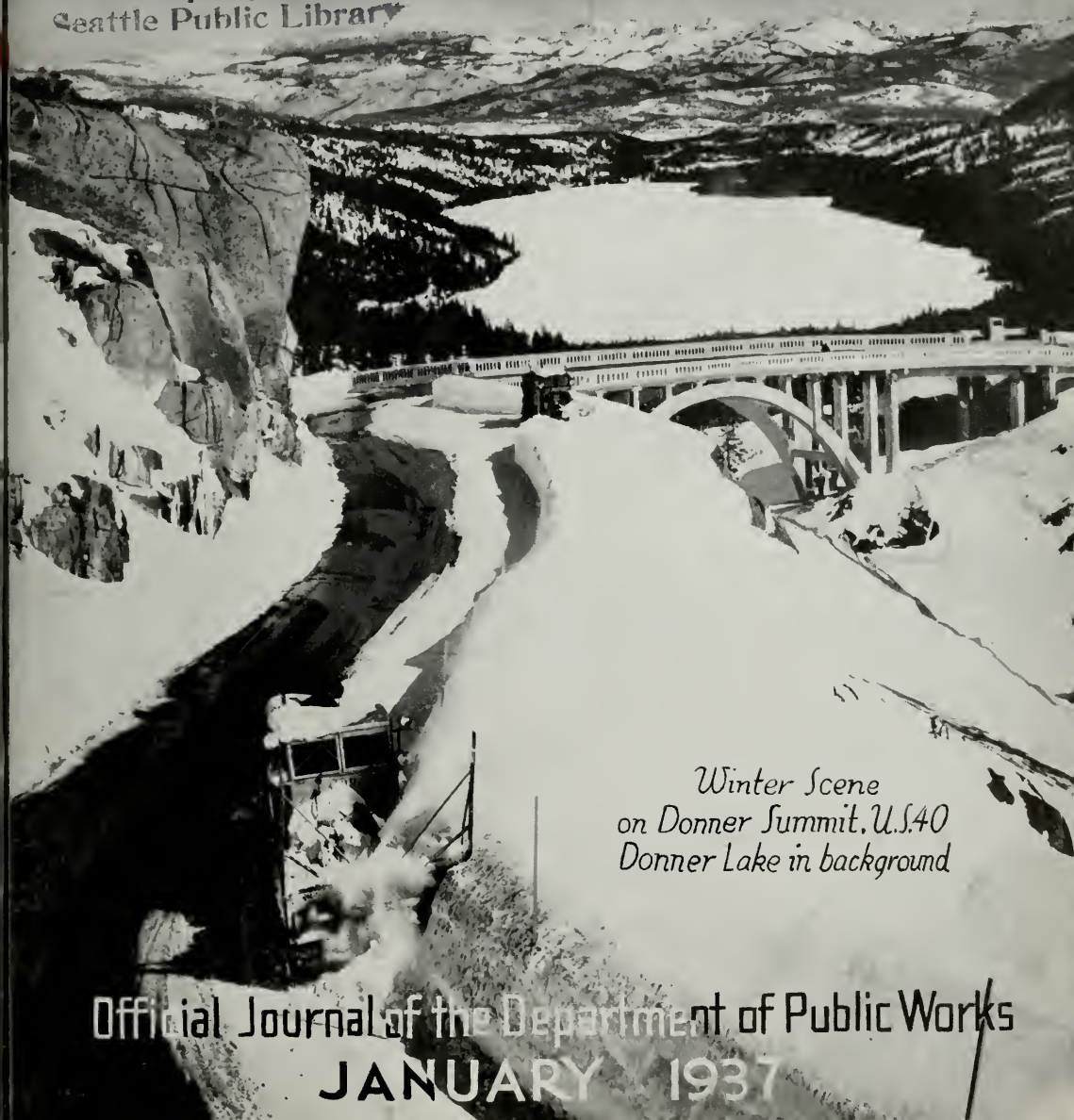


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Winter Scene
on Donner Summit, U.S.40
Donner Lake in background

Official Journal of the Department of Public Works
JANUARY 1937

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways of the Department of Public Works, State of California

EARL LEE KELLY, Director | C. H. PURCELL, State Highway Engineer | JOHN W. HOWE, Editor

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$27,576,900 for Construction of Major Projects in State Highway Biennial Budget

By HARRY A. HOPKINS
Chairman California Highway Commission

THE Biennial State Highway Budget for the 89th and 90th fiscal years, July 1, 1937, to June 30, 1939, was adopted by the California Highway Commission on December 19, 1936, and transmitted to Governor Merriam.

The budget shows that after deduction for maintenance of the 14,000 miles of State highway, for the ½ cent allocation to cities, for rights of way, joint highway districts, engineering, minor improvements and betterments, administration and contingency reserves, the total amount available for major project construction throughout the State will be $27,576,900.

There are three sources from which State highway revenues are derived. They are, first, the gas tax, which is estimated to produce $58,000,000 in two years; second, motor vehicle fees for which the State's share of the net amount available for distribution to the State and the counties is estimated at $6,200,000; and third, Federal Aid appropriated for the fiscal years 1938 and 1939 in the Hayden-Cartwright act of 1936, California's share of which is estimated at $9,500,000. The following tabulation shows this estimate of revenues:

Gas tax (State highway share) $58,000,000; motor vehicle fees (State highway share) $6,200,000; Federal aid (1938-1939 fiscal year appropriation) $9,500,000; total, $73,700,000.

The estimated revenues for the 89th and 90th fiscal years are available for and must cover all purposes included in the administration of State highways. The allocation of these revenues is made in accordance with various provisions of legislative enactment, requires distribution to the north and south sections of the State to primary and secondary highways, to cities, joint highway districts and



HARRY A. HOPKINS

to the various purposes and functions involved in State highway administration.

The general functions to which moneys are apportioned include administration, maintenance and cities. For administration $2,571,680 is set up; for maintenance $16,478,320. The half-cent, allocated to cities on the basis of population that each city bears to the total city population, is $14,500,000. The total of these three amounts is $33,550,000, leaving a balance available for major project construction and improvement, engineering, rights of way, joint highway districts and contingencies of $40,150,000.

Distribution of this amount for the various purposes provided by statute to the north and south county groups, to primary and secondary roads, shows the final amount available for major project construction is $27,576,900. This amount has been allocated to 169 major projects shown in the tabulations accompanying this article.

Federal appropriations for feeder or secondary roads and for grade crossing elimination made by the Hayden-Cartwright act of 1936 are not included in this budget since the funds are not yet available for programming or for distribution. These appropriations are Federal contributions for special and definite purposes to be distributed in accordance with Federal regulations, not yet promulgated and over which the Federal government will exercise final approval, and for the expenditure of which the State acts primarily only as an agent for the Federal government.

Tabulations of budgeted major construction projects will be found on pages 10, 11 and 12 detailing the county, State Highway route, location, extent and nature of improvement and proposed expenditure.

(Continued on page 10)

Grading Marin Approach to Gate Bridge Nears Completion on Schedule

By JNO. H. SKEGGS, District Engineer

BRIDGE-CONSCIOUS in a large way, the people of the San Francisco Bay metropolitan area, with the San Francisco-Oakland Bay Bridge a reality, are looking forward with eager anticipation for the opening to traffic of the Golden Gate span, largest over-water suspension structure in the world.

The San Francisco-Oakland Bay Bridge was opened for automobile travel on November 12, 1936, and the occasion was duly celebrated and this record breaking monument to engineering skill now is serving millions of persons monthly.

The Golden Gate Bridge is scheduled for completion during next May, and San Francisco and the North Coast Counties of California's Redwood Empire, comprising the Golden Gate Bridge and Highway District, are now planning the celebration for this historic achievement.

APPROACHES IMPORTANT

Paralleling the preparations for the Golden Gate Bridge celebration, construction progress is approaching its final stages on the various related portions of the project. Steel work on the bridge has been completed, paving is under way, and to the casual observer, the magnificent structure now has every appearance of a completed monument; but spectacular and gigantic as is this important structure, its fundamental usefulness depends upon the approach highways and system of roads serving it at either end.

The Division of Highways of the State Department of Public Works has assumed the responsibility of constructing the mountainous Marin County highway approach connecting the bridge with the Redwood Highway at Waldo. The scope of the heavy grading and tunneling contracts involved was discussed in the May, 1936, issue of this publication. Construction progress to the first of the year is briefly reported as follows:

T. E. Connolly, Inc., the contractor on the construction of the 1000-foot length tunnel, with portals and roadway approaches, has been fortunate in encountering no particularly unstable formations. This contractor has followed a construction scheme involving an 8 by 8 foot crown drift and two 14 by 12 foot wall drifts, with frequent stoping sections connecting the wall and crown drifts for ventilation and safety measures.

MUCH WORK COMPLETED

The crown drift was started at the south portal on June 2d; at the north portal on June 16th; and was holed through, at a point 375 feet from the north portal, on June 30th. All drilling was with jackhammers, all material was hand-mucked, and this drift required timbering for approximately 57 per cent of its length, mostly at the northerly end.

The left wall drift was started at the south portal on June 9th; at the north portal July 30th; and was holed through on September 14th at a point 134 feet from the north portal. The heading from the south portal was drilled with water leyners, the material being machine-mucked. The heading from the north portal was drilled with jackhammers and was hand-mucked.

WALL DRIFTS CONNECTED

The right wall drift was driven from the south portal only, and deadended at a point 54 feet from the north portal, being the approximate division line between tunnel excavation and roadway excavation. An 8 by 8 foot cross drift was constructed, diagonally connecting the right wall drift at its northerly dead-end with the left wall drift, to provide access for concreting. The right wall drift was drilled with water leyners, material being removed by machine muckers. It was necessary to provide ventilation equipment in one drift.

Although both the left and right wall drifts were timbered through with sets of 8 by 8 inch posts and 10 by 10 inch caps at approximate seven-foot centers, there was no evidence of any weight upon the timbering. It was used as a safety measure and as a basis for mucking traps for ringing-out operations.

The concrete aggregate bunkers for this project are located at Waldo Point. The concrete mixing plant is located on an access roadway (Prospect Avenue) near, but about one hundred feet in elevation below the north portal. A concrete pump located at the north portal is connected with the mixing plant by means of a skip incline. One to two inch slump concrete has been pumped a distance of 1100 feet, using but one cylinder of the pump.

Concreting of the side walls to the spring line was started October 10th and finished December 11th. Ringing-out of the arch ring and setting of steel beams was started November 30th. One jumbo form for concreting the arch rings was ready for operation the first of the year, and a second scheduled to start shortly thereafter.

HEAVY SLIDES ENCOUNTERED

Preparations for installation of a sodium vapor lighting system in the tunnel are progressing with the tunnel construction. Macco Construction Co., contractor on the grading between Waldo and the bridge on both sides of the tunnel, has been making good progress in spite of a number of anticipated heavy slides. This contractor has been using eleven large tractors, varying from 75 to 90 h.p.; eleven Le Tourneau carryalls of 13-yards capacity, and three 2–2½-yard semi-diesel power shovels, with some forty trucks, varying from five to eight yards capacity.

(Continued on page 9)



Upper—View from near north abutment of Golden Gate Bridge shows heavy grading work on Marin approach. Center—Constructing highway approach at north abutment of bridge. Lower—Placing of steel and form work at south portal of tunnel through hills. Inset—Ventilation precautions in wall drift.

Highway Crews Fight Blizzard Snowstorm, Rescue Autoists

By A. COONROD, District Office Engineer

SNOW storms which started on Sunday, December 27, and three days later developed into one of the worst blizzards in the history of San Bernardino County tested the mettle of the maintenance crews of the Division of Highways in District VIII to the utmost.

Hundreds of persons were marooned at various resorts in the San Bernardino mountains and District Highway Engineer E. Q. Sullivan kept huge snowplows working day and night to clear roads for their release.

With the blizzard still raging and with a snowfall of from three to five feet in Big Bear Valley, all highways into the mountain area were ordered closed on December 30. The day before, snowfall on the level in Big Bear Valley was 54 inches.

The storm brought the season's rainfall for San Bernardino to 13.28 inches on January 1, a record second only to that of the year 1889.

PLOWS WORKED ALL NIGHT

Coming as it did during the holidays, the blizzard presented the snow removal crews with a most serious traffic problem. Great snow banks, fallen trees and landslides sealed roads in many places. State highway crews struggled night and day to force snowplows through great drifts of snow and debris.

Without careful regulation, all cleared roadways would soon have filled with cars blocking their own way. Such a blockade would have resulted in much human suffering, if not loss of life. It was necessary that careful supervision of traffic be maintained and during the storms only such vehicles as were on urgent business were allowed to pass into the snow area.

Outgoing machines were permitted to move first, thus relieving congestion and forestalling a possible food shortage among those marooned.

By January 1, Nature was in complete control of the San Bernardino Mountains while fatigued highway crews, after opening a road to Crestline and Lake Arrowhead, battled their way toward Big Bear Valley and upper Santa Ana canyon resorts. In Lake Arrowhead, snow was two to three feet deep.

RELEASED 800 YOUTHS

Shortly before travel was prohibited, State highway maintenance crews were successful in releasing 800 southern California boys and girls in a number of mountain camps.

Efforts of Division of Highways workers to break through to Running Springs against snow drifts 16 to 18 feet deep were temporarily halted on New Year's Day by fallen trees and a landslide.

On this day traffic conditions at Big Pines and Wrightwood taxed the ingenuity of the California Highway Patrol and the maintenance department. All cars were compelled to discharge passengers at Big Pine and then were turned around facing out of the resort. At one time there was a line of parked cars six miles long.

MAROONED RESORTS AIDED

On the Rim of the World road high winds piled up 14-foot snow drifts and blew big trees down across the highway.

The night of January 2, Lake Arrowhead had been without electric lights and telephone service for four days and the water system was not functioning. A convoy of trucks with food supplies was taken into the resort on that night by the Division of Highways.

Considerable fear was aroused for the safety of 150 Boy Scouts encamped in the Barton Flats area. Superintendent John Davidson of the highway forces went into the district on snowshoes and reported to District Engineer Sullivan that he had found the boys with plenty of food. Sullivan ordered the largest of his rotary plows to clear a road to Barton Flats, a job that required three days.

KEPT TOUCH BY RADIO

During the storm the only communication with Big Bear Valley was between amateur radio stations W6MN of Big Bear and W6LRX of San Bernardino. These stations kept the Division of Highways in constant touch with the situation in the isolated area.

When the roads finally were opened no cars were allowed to proceed into the Big Bear and Lake Arrowhead districts until all persons confined there who wanted to leave had come out.

Throughout the blizzard, highway maintenance crews succeeded in keeping open the State highway into Los Angeles County's playgrounds at Big Pines.

CONVOYS OF AUTOS

Sleet and snow iced the National Old Trails highway in Cajon Pass, where between three and five feet of snow fell. All cars bound for Lake Arrowhead, Big Bear Valley, Crestline and other mountain resorts were halted at the Arrowhead arch.

On the Waterman canyon road from San Bernardino convoys of cars were taken up on New Year's Day by the California Highway Patrol. District Engineer Sullivan adopted this precaution to lessen the danger to motorists from falling rocks and slides on the road.

Tireless work on the part of snow plow crews opened the Rim of the World highway for travel to Lake Arrowhead at 6 a.m. on the morning of January 3.

For ten days every man of the maintenance crews of District VIII and every piece of snow removal equipment was in continuous service.



Scenes in San Bernardino Mountains where crews of the Maintenance Department of the Division of Highways battled for ten days and nights to clear roads leading to Lake Arrowhead, Big Bear Valley, Barton Flats, Big Pines and other points where motorists and pleasure seekers were marooned by the worst snow storm in a decade. Upper—Cars parked at Big Pines headed out of the region to prevent traffic jam. Center right—Blower plow at work opening road. Lower left—Plow working way through five-foot snow drifts. Lower right—Two way road opened through heavy drifts of "No man's" land.

Opening of Newport Overhead Solves Bad Traffic Problem

By A. D. GRIFFIN, District Office Engineer

SOUTHERN California motorists were provided with a new Gateway to the Sea when Governor Frank F. Merriam on Saturday, November 28, officially dedicated the Newport Beach Grade Separation in Orange County.

Ceremonies attending the opening of the new overhead crossing were unique in that the usual procedure of cutting a ribbon barrier across the roadway was replaced by an innovation. An imitation stone wall was erected across the viaduct with a gate in the center. The oldest farm gate in Orange County, one that had served for many years on the great Irvine Ranch, was used. It was held closed with bailing wire and bore a "Keep Out" sign.

With the words, "I dedicate this overpass to the use of the people of the Golden State of California," Governor Merriam cut the wire with a pair of heavy pliers, tore down the warning sign disclosing one that read "Welcome," and flung open the ancient gate.

The Governor then entered his automobile and led a procession of cars across the viaduct to Newport.

SERIOUS TRAFFIC PROBLEM

At Newport Beach, where the roadway entering the city crossed the Coast Highway, there existed for years a serious traffic problem. Travel on both roads during the summer months is very heavy. With the Coast Highway carrying the limit of vehicles, especially on Sundays and holidays, the crossing traffic was enormous and hours of delay resulted.

With completion of the overhead crossing, the viaduct now carries all traffic entering and leaving the city of Newport Beach and permits the travel along the Coast Highway from Long Beach to San Diego to flow without interruption.

Four ramps connect the Coast road with the Newport-Santa Ana highway running overhead. These ramps are so planned that all turns are to the right, thus doing away with cross-traffic.

Motorists using the new crossing should remember that no vehicle shall cross the Coast Highway, either east or west, except by the overhead roadway, and that no left hand turns are permitted at any intersection created by the construction of the bridge.

NO RIGHT TURNS

Autoists wishing, for instance, to go from Santa Ana to Laguna Beach must cross the viaduct toward Newport, make a right turn at the right-hand ramp after crossing, go down the ramp and turn right onto the Coast Highway. Those wishing to go from Laguna Beach to Newport pass under the bridge on the Coast Highway, turn right at the right-hand ramp after passing under the bridge, go up the ramp and turn right, crossing over the bridge.

The Newport Beach Grade Separation was first proposed about eight years ago to carry the Newport-Santa Ana Road, then a County highway, over the State Coast Highway.

Newport-Santa Ana Road, now State Highway Route 43, was taken into the State Highway system on August 14, 1931.

RIGHTS OF WAY OBTAINED

In the early part of July, 1935, after many months of negotiation, the State entered into an agreement with the Southern Pacific Railroad Company whereby the State purchased the railroad's Newport Beach Line right-of-way between Dyer Road and Newport Beach, a total distance of almost eight miles, for the sum of $8,428.

A portion of this right-of-way is now used for the new grade separation and the balance of this right-of-way will be used at some future time for the widening and improvement of State Highway Route 43, northerly from the Newport Beach Grade Separation. The city of Newport Beach, through agreement with the Southern Pacific Railroad, purchased that portion of the railroad's right-of-way within the city that was needed for construction of the grade separation.

All other rights-of-way for this improvement were secured by donation from abutting property owners.

HEAVY TRAFFIC COUNTS

Traffic counts taken on Sunday, July 12, 1936, show a count of 12,397 vehicles between 6 a.m. and 10 p.m. on the Santa Ana-Newport Road, State Highway Route 43, and a count of 15,818 vehicles between the same hours on the coast road, State Highway Route 60.

This project was financed from the Major Project Allocation for Construction and Improvement of Highways—Primary South, in the budget for the 85th-86th fiscal years, which allocated $180,000.00 for the improvement.

Completion of it has eliminated a congestion point which frequently on Sunday afternoons during the summer months has held up cars an hour or more in negotiating this intersection.

APPROXIMATE COST $170,000

Bids for the project were opened October 31, 1935. The contract was awarded by the Director of Public Works on November 7, 1935, and approved by the Attorney General on November 25, 1935. Work was started on November 12, 1935, and was completed November, 1936. The total cost of the project will be approximately $170,000.

Construction consisted of a new bridge over the Newport Bay Channel, a new bridge to carry the Santa Ana-Newport Bay Road over the Coast Highway, grading and paving of approaches, grading and paving of the northwest ramp and the southwest



At top, view of Newport overhead, showing east and west ramps and Coast Highway passing under viaduct. Center—Official party at dedication; (left to right) City Engineer R. L. Patterson, Newport; S. V. Cortelyou, District Highway Engineer; Assistant Director of Public Works Justus F. Craemer; Mayor Harry Williamson, Newport; Mrs. Philip A. Stanton, Julien D. Roussel, secretary California Highway Commission; Highway Commissioner Philip A. Stanton; Governor Frank F. Merriam.

Inset—Governor Merriam cuts wire which held closed old gate barrier. At bottom—Portion of crowd attending dedication, including Sea Scouts, and ancient ranch gate unlocked by Governor Merriam.

ramp connecting the Coast Highway with the high line of the Santa Ana-Newport Beach Road, grading and paving of the east ramp to provide connection between Newport Beach and points southerly along the coast.

The bridge over the Coast Highway is of reinforced concrete girder type, is 158 feet long and has a 44-foot clear roadway width and two three and one-half foot sidewalks.

WIDE APPROACHES

The bridge over the Newport Channel is of reinforced concrete girder type, is 206 feet long, has a 44-foot clear roadway width and one five-foot sidewalk, and is built on five bents consisting of 84 reinforced concrete piles.

There are 2015 cubic yards of concrete, 400,000 pounds of reinforcing steel and 75,000 pounds of structural steel in the two structures. The approaches to the two bridges have a 52-foot roadway and are paved 40 feet wide with Portland cement concrete and asphalt concrete. Curbs have been constructed on both sides and a five-foot sidewalk on one side.

The northwest ramp is graded 76 feet wide and paved with Portland cement concrete 20 feet in width.

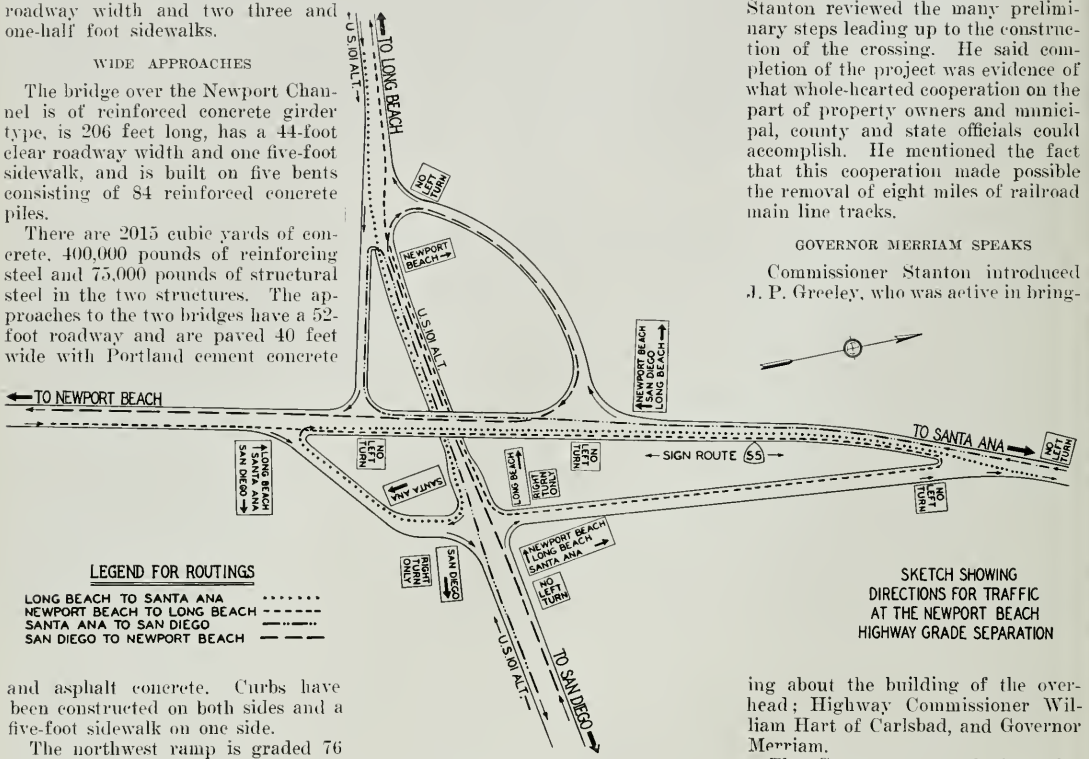
ALL RAMPS PAVED

The southwest and east ramps are paved with Portland cement concrete 20 feet wide and Portland cement concrete curbs and two-foot concrete gutters have been constructed.

The existing grade of State Highway Route 60 (Coast Route) was raised approximately three feet in order to eliminate the dip in pavement under the old road separation and a new 40-foot asphalt concrete pavement was laid with Portland cement concrete curbs and one five-foot Portland cement concrete sidewalk, an overall length of 800 feet.

The Newport Channel Bridge has one removable span to comply with Federal regulations governing navigable streams.

The system of side road ramp connections will permit of a free flow of traffic in all directions, whatever the destination may be of vehicles coming into the grade separation.



SKETCH SHOWING DIRECTIONS FOR TRAFFIC AT THE NEWPORT BEACH HIGHWAY GRADE SEPARATION

The lighting system which consists of 32 ornamental light standards, each containing 250 candle power lamps, and will provide illumination for the entire project, was paid for from funds provided by the city of Newport Beach.

All slope cuts are to be planted immediately after construction.

SPLENDID COOPERATION

This project embodies all the modern developments in highway grade separations gained by many years of construction experience and extensive studies of traffic flow at this location and elsewhere, and in the future the traveling public journeying in the vicinity of Newport Beach will find a traffic facility that will greatly add to their comfort, convenience and safety and save them many wearisome and nerve-wrecking delays.

State Highway Commissioner Phillip A. Stanton presided at the dedication ceremonies, being introduced by Sam A. Meyer, president of the Newport Chamber of Commerce. Mr. Stanton reviewed the many preliminary steps leading up to the construction of the crossing. He said completion of the project was evidence of what whole-hearted cooperation on the part of property owners and municipal, county and state officials could accomplish. He mentioned the fact that this cooperation made possible the removal of eight miles of railroad main line tracks.

GOVERNOR MERRIAM SPEAKS

Commissioner Stanton introduced J. P. Greeley, who was active in bringing about the building of the overhead; Highway Commissioner William Hart of Carlsbad, and Governor Merriam.

The Governor stressed the point that in the working out of the project there was complete harmony among all interested parties. He predicted that by the end of 1937 the unfinished section of the Coast Highway in the Wilmington and San Pedro district would be completed.

Touching upon the subject of gas tax revenues with which the project was built, the Governor said that the definite expression of the voters at the November election against gas tax diversion, left no doubt that the people of California are determined that their gas tax monies shall be used for highway purposes exclusively and not diverted to any

other uses. He said that as far as he is concerned, the gas tax diversion issue is settled and that gasoline tax funds will be devoted solely to highway construction and maintenance.

SEA SCOUTS ATTEND

Adding color to the dedication ceremonies were five hundred Sea Scouts from five western states, who were reviewed by the Governor. The Sea Scouts, who were in "Rendezvous" at Newport Harbor for three days, November 27, 28 and 29, provided a guard of honor for the Governor. Present were the mayors of all Orange County cities, the mayors of Long Beach, Riverside and Pasadena, members and members-elect of the legislature from Orange, state and county officials and officers and members of the Newport Harbor Yacht Club, of which the Governor is an honorary commodore. For the occasion, the Governor wore a commodore's cap.

Preceding the viaduct opening, the Governor and visiting officials were entertained at a luncheon in the ballroom of the Yacht Club. President Meyer of the Chamber of Commerce acted as toastmaster and introduced the guest mayors.

Former Speaker of the Assembly Ted Craig introduced Senator-elect Harry Westover and Assemblymen-elect T. H. Kuchel and Clyde Watson. Highway Commissioner Hart, Julien D. Roussel, secretary of the California Highway Commission, and S. V. Cortelyou, District Highway Engineer, were presented by Justus F. Craemer, Assistant Director of the Department of Public Works.

During the ceremonies at the viaduct a salute of 21 aerial bombs announced the arrival of the Governor and a display of daylight fireworks followed the opening.

In the course of the celebration, Division of Highway officials joined with their hosts in acknowledging the aid given to the project by R. L. Patterson, City Engineer of Newport; N. H. Neff, Orange County Engineer; R. C. Mize, attorney for most of the property owners who cooperated; F. M. Strobridge, who donated large areas of land needed for the work, and George and Alfred Machris, who donated necessary rights-of-way.

In the construction of the Bay Bridge the labor alone amounted to the equivalent of 55,000,000 men, each working for one hour.

U. S. Confers High Honor on Chief Engineer Purcell

The following correspondence recently released by State Highway Engineer C. H. Purcell reveals his appointment by President Roosevelt as a representative of the United States on the International Road Congress Commission.

November 18, 1936

Honorable Cordell Hull,
Secretary of State,
Washington, D. C.

Dear Mr. Hull:

I am in receipt of letter dated November 11th, together with certificate of designation covering my appointment as a representative of the United States, on the Permanent International Commission of the Permanent International Association of Road Congresses.

It is indeed a gratification to me to accept this appointment, and I feel greatly honored to be included in this very able representation as designated by the President of the United States. It will be my pleasure to serve on this Commission for the promotion of highway development in the United States and our neighboring countries.

I wish to express to you and, through you, to President Roosevelt my deep appreciation for the confidence reposed in me.

With kindest personal regards, I am,

Yours very truly,

(Original signed by)
C. H. PURCELL,
State Highway Engineer.

At the cable anchorages, huge splay castings were applied to the suspension cables before wrapping. These graduated the size of the cable from its fan-shaped spread at the eyebars to its closely-compacted load-carrying size. After being spirally wrapped with wire, the cables were given four coats of paint.

Heavy Grading Involved in Marin Approach to Bridge

(Continued from page 2)

This contractor has averaged more than a quarter of a million yards of roadway excavation per month since starting work, with a high monthly yardage of approximately one-third of a million yards.

BIG GRADING JOB

Including slide removal, more than two million yards of material had been moved as of the first of January, 1937, with grading practically completed for the 2.6 mile section north of the tunnel. The grading south of the tunnel in the U. S. Military Reservation consists primarily of taking material from one major cut of some 500,000 cubic yards, the major portion of which has been removed at the present time.

The difficulties of construction of the four-lane Marin approach highway are not readily apparent. Mountainous highways have been built elsewhere, but have generally been limited to two traffic lane capacity, due to combined light travel and prohibitive construction costs. This particular area, however, is so shaken by earthquakes of the past and is located so close to a major earthquake fault, that the disturbance of its present equilibrium with the heavy cuts and fills required, provides unpredictable hazards from slides.

Provision for stable foundations for the heavy fills has required removal of soft material to depths of as much as forty feet, with rock backfill and other special drainage provisions.

It is probable that this section of highway will not become fully stabilized for a number of years to come, but the achievement in opening it to traffic with the Golden Gate Bridge is one of the remarkable features of the project as a whole.

All-risk insurance to the extent of thirty-three million dollars was carried by the contractors on the various units of Bay Bridge construction.

"I can not learn to love you."
"But I've saved $10,000."
"Give me one more lesson."

DETAIL OF MAJOR PROJECT ALLOCATIONS BUDGETED FOR

PRIMARY NORTH

County	Route	Location	Approximate mileage	Nature of Improvement	Proposed expenditures 89th and 90th fiscal years detail
Mendocino	1	South Boundary to Hopland	10.9	Surfacing and shoulders	$115,000
Humboldt	1	Beatrice Overhead to Bucksport	6.6	Surfacing and shoulders	70,000
Mendocino	1	Bridges Creek		Bridge and approaches	16,000
Del Norte	1	Myrtle Creek		Bridge and approaches	49,000
Humboldt	1	Big Lagoon	0.7	Bridge and approaches	50,000
Mendocino	1	Crawford Ranch to Ukiah (portions)	5.0	Grading, surfacing and bridges	200,000
Del Norte	1	1 mile north Wilson Creek to Last Chance Slide	2.0	Grading and surfacing	190,000
Mendocino	1	Sapp Creek to Pepperwood School	2.0	Grading and surfacing	195,000
Mendocino	1	McCoy Creek to Piercy	2.7	Grading and surfacing	160,000
Humboldt	1	Phillipsville to Jordan Creek (portions)		Grading and surfacing	250,000
Tehama	3	Sacramento River at Red Bluff		Bridge and approaches	300,000
Lassen-Modoc	28	Nubieber to Adin	15.4	Surfacing	165,000
Butte-Plumas	21	West Fork to Keddie (portions)	53.0	Surfacing and misc. structures	138,000
Modoc	28	Hot Creek to Alturas	7.6	Grading and surfacing	200,000
Modoc	28	In Alturas	1.2	Grading and surfacing	25,000
Lassen	29	Coppervale to Susanville (portions)	5.0	Grading and surfacing	260,000
Shasta	3	China Gulch		Structure, grading and surfacing	25,000
Plumas	21	Spanish Creek		Bridge and approaches	65,000
Glenn	7	Willows to Artois	6.0	Grading, paving and bridges	225,000
Colusa-Glenn	7	Delevan to Logandale	6.7	Grading and paving	200,000
Nevada-Sierra	38	Hirschdale to Nevada State Line	10.0	Grading and surfacing	300,000
Placer	17	Roseville to Rocklin	2.6	Grading and paving	100,000
Placer	37	At Colfax	1.5	Grading and paving	75,000
El Dorado	11	El Dorado to Clarks Corners and Webber Creek	5.0	Grading, paving and bridges	250,000
Nevada-Yuba-Sierra	25	Nevada City to Downieville (portions)		Grading and surfacing	100,000
Alameda	5	Greenville to Mountainhouse	9.0	Grading and surfacing	800,000
Santa Cruz-Santa Clara	5	Oaks to Inspiration Point	5.7	Grading, surfacing and structures	765,000
Santa Clara	2	Coyote to Paradise Valley Road and Llagas Creek	9.3	Grading, paving and bridges	392,000
Santa Clara-San Benito	2	1 mile south Pajaro River to Sargent Crossing	1.9	Bridge, grading and paving	242,000
Santa Clara	68	Route 5 to San Antonio Street and Coyote Creek (portions)	2.5	Grading, paving and bridge	275,000
Alameda	5	Foothill Blvd.-San Leandro to Castro Valley	3.2	Grading and paving	300,000
Alameda-San Francisco	5-68	San Francisco-Oakland Bay Bridge		Operation, insurance and maintenance	600,000
Monterey	2	Salinas River at Soledad	1.0	Bridge, grading and paving	415,000
Monterey	2	Welby Grade Change	0.7	Grading and surfacing	43,000
Fresno	4	½ mile south to ¾ mile north of Selma	2.0	Grading and paving	150,000
Merced	4	8 miles south of Merced to Black Rascal Creek	10.1	Grading, paving and bridges	450,000
Solano	7	Carquinez Bridge to 1 mile north	1.0	Grading and paving	75,000
San Joaquin-Sacramento	4	Jahant Corners to Galt and Dry Creek	5.0	Bridge, grading and paving	385,000
Stanislaus	4	Ceres to Hatch Crossing and Modesto to 4 miles north	5.4	Grading and paving	250,000
Calaveras	24	Valley Springs to San Andreas and Calaveras River (portions)	6.0	Grading, surfacing and bridge	260,000
Merced	4	At Livingston	1.7	Grading and paving	100,000
Total Primary North					$9,225,000

PRIMARY SOUTH

County	Route	Location	Approximate mileage	Nature of Improvement	Proposed expenditures 89th and 90th fiscal years detail
Santa Barbara	2	Nojoqui Canyon and Nojoqui Creek	3.0	Grading, paving and bridges	$374,000
Santa Barbara	2	Rincon to 1 mile north	1.1	Grading and paving	48,000
Santa Barbara	2	Refugio Creek to Tajiguas Creek	2.0	Grading, paving and bridge	200,000
Kern	4	Grapevine to 10 miles south of Bakersfield	18.5	Grading and paving	720,000
Tulare	10	Venida to Yokohl	2.8	Grading and pavement widening	100,000
Tulare	4	Kings River		Bridge and approaches	205,000
Los Angeles	23	Newhall Tunnel	0.4	Grading and paving	215,000
Los Angeles-Ventura	2	Calabasas to Conejo Grade (portions)		Grading and surfacing	200,000
Orange	2	Capistrano to Galivan Overhead		Drainage correction	25,000
Ventura	60	Big Sycamore Canyon	0.7	Grading, paving and bridge	120,000
Los Angeles	9	Foothill Blvd.; Lorraine Ave. to Claremont	8.0	Widening roadbed, culverts	50,000
Los Angeles	60	Encinal Canyon to Winter Canyon	11.0	Grading, paving and bridges	800,000
Ventura	60	Point Magu to Little Sycamore Creek		Shore protection and widening roadbed	150,000
Los Angeles	23	Newhall Tunnel to Mint Canyon Cut-off	1.0	Grading and paving	65,000
Los Angeles	23	1 mile north Newhall Tunnel to Solamint	5.6	Grading, paving, bridge and grade separation	550,000
Ventura	2	North of Sea Cliff		Storm protection, drainage	25,000
Los Angeles	60	Lincoln Blvd.; Olympic Blvd. to Washington Blvd.	3.0	Grading and paving	250,000

CONSTRUCTION OF HIGHWAYS IN 89th-90th FISCAL YEARS

PRIMARY SOUTH—Continued

County	Route	Location	Approximate mileage	Nature of Improvement	Proposed expenditures 89th and 90th fiscal years detail
Los Angeles	23	Tunnel Station to Newhall Tunnel	0.9	Grading and paving	$70,000
Los Angeles	2	Whittier Blvd.; Philadelphia St. to Painter Ave.	1.5	Grading and paving	45,000
San Bernardino-Riverside	26	Beaumont to Redlands (portions)		Grading, surfacing and paving	75,000
San Bernardino	26	Reservoir Canyon Road; Highland Ave. to East City Limits	1.7	Grading and paving	80,000
San Bernardino	9	West County Boundary to San Bernardino	21.9	Grading and pavement widening	483,000
San Bernardino	26	West County Boundary to Ontario	2.2	Grading and pavement widening	50,000
San Bernardino	26	Ontario to Colton	17.1	Grading and pavement widening	380,000
Riverside	26	Lime revision near Whitewater		Grading and paving	50,000
Kern	23	Through town of Mojave	0.8	Grading and surfacing	36,000
Inyo	23	Through town of Lone Pine	0.6	Grading and surfacing	32,000
Inyo	23	Through town of Independence	0.6	Grading and surfacing	32,000
Kern	58	Mojave to East County Boundary	6.5	Grading and surfacing	58,000
Inyo	23	2 miles south to 2 miles north of Alabama Gate; Los Angeles City Aqueduct	4.0	Grading and surfacing	86,000
Kern	23	South County Boundary to 8.2 miles north	8.2	Surfacing	54,000
San Diego	2	2 miles south San Onofre to north County Boundary	3.3	Grading, paving and bridges	156,000
San Diego	12	West City Limits, La Mesa to El Cajon	3.7	Grading and paving	250,000
Riverside	26	Oasis St. to South City Limits in Indio	0.8	Grading and pavement widening	55,000
Riverside	26	Indio south to Route 64	1.5	Grading and pavement widening	66,000
Riverside	26	South County Boundary to Avenue 62		Storm protection	130,000
Riverside	64	Ehrenberg Bridge		Principal and interest on purchase	5,900
San Diego	2	Barnett Avenue to Head of Rose Canyon	9.7	Grading and pavement widening (cooperative)	100,000
Total, Primary South					$6,389,900
Total, Primary, North and South					$15,614,900

SECONDARY NORTH

County	Route	Location	Approximate mileage	Nature of Improvement	Proposed expenditures 89th and 90th fiscal years detail
Mendocino	56	Various Bridges		Bridge replacement and approaches	$235,000
Lake	15	Old Quarry to Scott Valley	3.0	Grading and surfacing	100,000
Humboldt	46	Weitchpec to Orleans	15.0	Grading and surfacing	80,000
Humboldt-Trinity	20	Horse Mountains Summit to Bib Bar (portions)		Grading and oiling	150,000
Humboldt	35	Bridgeville to Carlotta (portions)		Grading and surfacing	35,000
Mendocino	48	Christine to Flynn Creek (portions)		Grading and surfacing	100,000
Siskiyou	72	Cougar to Macdoel	17	Grading and surfacing	300,000
Trinity	20	Junction City to Weaverville	8	Grading and oiling	270,000
Trinity	20	Oregon Mountain	1	Grading	76,000
Siskiyou	46	Scott River Bridge Approaches	1	Grading and oiling	30,000
Modoc	73	Pitt River in Alturas		Bridge	26,000
Siskiyou	82	Scott River		Bridge and approaches	25,000
Trinity	35	Big Creek and Hayfork Creek		Bridge and approaches	40,000
Sutter	15	Sutter City to Tarke; Sutter By-Pass	5.0	Bridge, grading and surfacing	400,000
Yuba	15	Dry Creek	0.6	Bridge and approaches	50,000
Yolo	50	Cache Creek near Rumsey	0.5	Bridge and approaches	75,000
Contra Costa	106	1 mile west of Muir to Willow Pass	10.3	Grading, surfacing and grade separation	470,000
Santa Clara	42	Saratoga Gap to Los Gatos (portions)	1.5	Grading and surfacing	125,000
Santa Clara	32	1 mile east Bell Station to east county boundary	4.5	Grading, surfacing and bridges	575,000
Sonoma	104	Stony Point Road to Sebastopol and Guerneville to Northwood Park	4.0	Grading and surfacing	250,000
Santa Cruz	56	Davenport to north boundary	8.0	Grading, surfacing and bridge	180,000
Santa Cruz	116	Near Waterman Gap	1.0	Grading and surfacing	40,000
Marin	56	Stample Creek		Bridge	20,000
Monterey	56	Big Creek and Mud Creek		Bridges	195,000
Monterey	10	Peachtree Valley to Ridge	5.0	Grading and surfacing	206,000
San Benito	119	Tres Pinos to Paicines	4.8	Grading and surfacing	140,000
Madera	125	½ mile north Kelshaw to Coarse Gold	8.0	Surfacing	26,000
Madera	125	7.7 miles No. Lanes Bridge to ½ mile No. Kelshaw	11.3	Grading and surfacing	400,000
Fresno	41	Boulder Creek easterly	7.5	Grading	350,000
Fresno	41	Dunlap to Forest boundary	3.5	Grading and oiling	150,000
Kings	10	Hanford to 4 miles west	4.0	Grading and surfacing	100,000
Tuolumne	13	Stoddard Springs to McCoy Saddle	6.3	Surfacing	55,000
Merced	32	Los Banos to easterly boundary	19.9	Grading, surfacing and bridges	320,000
Total, Secondary North					$5,591,000

DETAIL OF MAJOR PROJECT ALLOCATION FOR CONSTRUCTION OF HIGHWAYS

SECONDARY SOUTH

County	Route	Location	Approximate mileage	Nature of Improvement	Proposed expenditures 89th and 90th fiscal years detail
San Luis Obispo	125	Atascadero Summit to 2 miles west of Atascadero Creek	3.3	Grading, surfacing and bridge	$128,000
Santa Barbara	80	Los Olivos to Zaca	2.9	Grading and surfacing	92,000
Santa Barbara	149	Santa Ynez River		Bridge and approaches	81,000
Santa Barbara	148	Guadalupe to Santa Maria	7.0	Grading and paving	210,000
Kern	58	Bear Mt. Ranch to Tehachapi (portions)		Grading	350,000
Kern	58	East of Monolith Plant		Bridge and approaches	20,000
Kern	33	West County Boundary, easterly (portions)		Surfacing	50,000
Tulare	129	Porterville northerly	1.0	Grading and paving	40,000
Los Angeles	158	Sepulveda Blvd.; Centinella Ave. to Jefferson	0.6	Grading and paving	50,000
Los Angeles-Ventura	79	Castaic to Santa Paula (portions)		Grading, surfacing and bridges	400,000
Orange	178	Center Street; jog at Placentia Ave.	0.5	Grading and paving	40,000
Orange	43	Tustin Ave.; jog at 17th	0.5	Grading and paving	25,000
Los Angeles	168	Rosemead Blvd.; Center St. to Foothill Blvd. (portions)		Grading and paving	175,000
Ventura	138	Line changes on Ventura Ave.; San Antonio Creek Bridge approaches and Ferguson Grade		Grading and surfacing	120,000
Los Angeles	175	Artesia Ave.; Alameda St. to Normandie Ave.	5.0	Grading and paving	265,000
Los Angeles	205	Arroyo Seco Parkway; Avenue 22, Los Angeles to Colorado St., Pasadena	7.2	Grading, paving and structures	500,000
Orange	184	Main Street extension, route 60 to route 43, Newport Bay	6.4	Grading, surfacing and bridge	175,000
Orange	181	Glassell St.; Olive to Orange	1.0	Grading and surfacing	50,000
Los Angeles	26	Barranca St. to Pomona	6.1	Widening roadbed, drainage	70,000
Orange	43	Line change east of Olive	0.8	Grading and paving	75,000
Los Angeles	165	Figueroa St.; 190th St. to Lomita Blvd.	5.0	Grading and surfacing	160,000
Orange	171	Huntington Beach Blvd.; Coast Blvd. to Garfield Avenue	2.6	Grading and surfacing	70,000
Orange	43	Santiago Creek on Tustin Ave.		Bridge	40,000
Los Angeles	163	Route 60 southerly, Santa Monica and Los Angeles (cooperative)		Grading and paving	100,000
Los Angeles	61	Verdugo Road; Glendale to Foothill Blvd.	0.8	Grading and paving	90,000
Los Angeles	173	Olympic Blvd. in city of Los Angeles (cooperative)		Grading and paving	400,000
Los Angeles	61	Angeles Crest Road; Chilao Flats easterly		Grading	350,000
Orange	179	Garden Grove Blvd.; through Garden Grove Millwood Ave. to 6th St.		Shoulders	20,000
Orange	171	Stanton and Grand Avenues; Garden Grove Ave. to north county boundary (portions)		Grading and paving	60,000
Los Angeles	77	Valley Blvd.; El Monte to Route 26	0.7	Pavement widening and shoulders	32,000
Los Angeles	62	Coldbrook Camp to Crystal Lake Park (portions)	7.0	Grading and widening	40,000
Orange	64	San Juan Capistrano to 1.6 miles east	1.6	Surfacing and widening	45,000
Los Angeles	26	Harrison Ave.; Soto St. to Indiana St.	0.6	Grading and paving	32,000
Los Angeles	26	Atlantic Ave. to New Avenue (portions)		Paving and resurfacing	65,000
San Bernardino	191	Cable Canyon Drain		Bridge and approaches	20,000
Riverside	43	West county boundary to Corona	4.7	Grading and paving	360,000
San Bernardino	43	South county boundary to Colton	2.6	Grading and paving	135,000
Riverside	187	Snow Creek to Route 26	3.9	Grading and surfacing	125,000
Riverside	187	South of Palm Springs (portions)		Grading and surfacing	30,000
San Bernardino	190	Mill Creek to Igo	3.0	Grading and surfacing	50,000
San Bernardino	188	Mt. Anderson to Crestline	1.3	Grading and surfacing	35,000
Mono	111	Route 23 (Cain ranch) to Grant Lake Dam	3.0	Grading and surfacing	43,000
Inyo	76	Route 23 (Texaco corner) to Owens River	3.0	Grading and surfacing	35,000
Kern	145	Near Rademacher	2.2	Grading and surfacing	16,000
Mono	40	Easterly Park boundary to Gardisky's	2.2	Grading and surfacing	54,000
Inyo	127	Soda Plant to 8 miles easterly	8.0	Grading and surfacing	35,000
Kern	145	Railroad crossing to 3 miles south Inyokern	0.5	Grading and surfacing	6,500
Kern	145	Randsburg Junction to 5.7 miles north	5.7	Grading and drainage	17,500
Mono	96	2.4 miles north of Bridgeport to State Line	10.0	Grading and oiling	20,000
Inyo	127	Towne's Pass to 3 miles west	3.0	Grading and surfacing	41,000
Inyo	127	East boundary Nat'l. Monument to 10 miles east	10.0	Grading and surfacing	68,000
San Diego	195	Rincon to Lake Henshaw (portions)		Grading	360,000
Imperial	202	3 miles East Calexico to East Highline	9.4	Grading, surfacing and bridge	197,000
Riverside	64	Junction Routes 187 and 64 easterly		Storm protection	35,000
Imperial	187	Holtville to Brawley (portions)		Grading and surfacing	120,000
Imperial	187	Brawley to Mulberry Ave.	4.6	Grading, surfacing and bridges	80,000
Riverside	187	Whitewater River and approaches	1.0	Grading, surfacing and bridges	78,000
Total, Secondary South					$6,371,000
Total Secondary, North and South					$11,962,000
Grand Total, Primary and Secondary					$27,576,900

California's Uniform Highway Sign System Described

By F. M. CARTER
Assistant Maintenance Engineer

IN ESTABLISHING a system of highway signs adequate to the great task of safeguarding and expediting traffic, certain principles must be observed that have resulted from careful studies and experiments over a period of years. It is necessary in the placing of signs that they be located at points where control, warning or guidance of traffic is imperative for public safety and convenience. The necessity for installing them at these points should be determined by all obtainable facts on traffic and accident hazard conditions and backed up by field studies.

The value of a sign depends upon its visibility and the correct and consistent use of the same sign, identically situated, to give the same meaning wherever it is seen. Uniformity of signs will enable the traveler to obtain the same message, in the same manner, in every locality in our state as well as in other states. This is the aim of our road signing.

The position of the signs is for normal conditions. The proper distance in advance at any place or condition to which its message applies depends on the usual speed of approach, the character of alignment and the nature of the topography.

EVERY SIGN ESSENTIAL

Every sign displayed is for a definite and specific purpose, and unless necessary would not be on the highway.

Special attention is given to placing only those signs considered absolutely essential at intersections.

A too free use of warning signs would soon breed disregard of all such signs and the very purpose intended to be accomplished by their use would be defeated. Therefore this is one of the factors considered in the study of each individual location made before signs are placed.

A highway, where curves are frequent does not need so many curve signs as a highway having fewer curves. On highways having long tangents (long, straight stretches) curve signs are placed at every curve approached.

Signs must tell the motorist the truth, or they will soon be disregarded.

There are three major functional groups of highway signs, namely, Regulatory, Warning and Guide. This grouping or classification follows the standard adopted by the United States Bureau of Public Roads, and published in its Manual on Uniform Signing and Traffic Control.

IN DISTINCTIVE GROUPS

In order that the signs in each group may be readily distinguished, a special color and shape is used to designate each group. This provides uniformity of significance in the signs themselves and enables motorists to rapidly acquire familiarity with them.

Since the effectiveness of signs must depend upon established legal authority, traffic signs are placed only under authorization of the Director of the State Department of Public Works, pursuant to the provisions of the Vehicle Code and established rules of the road, for the purpose of regulating, warning and guiding traffic on State highways.

The signs tell the motorist exactly what he needs to know, with regard to hazards ahead, as well as routes and distances, and are of uniform aspect, location and meaning all over the country.

PLACING SCHOOL SIGNS

One of the greatest problems of the Division of Highways is to care for and safeguard school children. Signs placed for them should always be at locations where protection is needed. Signs giving information or warning at crossings, using the word "school," should be used only for school hours and should be positioned only for the hours when school children are crossing the highway and should be removed when such crossing is not used for school children.

School zone signs should be used only when the school or the grounds of the school are contiguous to the highway.

The first definite step towards standardization of traffic control devices was taken by the American Association of State Highway Officials in the preparation of its Manual on Uniform Traffic Devices for Streets and Highways originally published in January, 1927. That manual was prepared primarily for use on rural highways and covered signs only, including STOP signs and a few other regulatory signs, warning signs and guide signs. It established definite shapes and color combinations for different purposes and included standards for marking the newly adopted system of major United States highways.

CERTAIN SYMBOLS ADOPTED

In response to a popular demand for a similar manual for urban use, the American Engineering Council, at the request of the National Conference on Street and Highway Safety, undertook the compilation of such a manual which, after extensive study, was approved by the Third National Conference on Street and Highway Safety in 1930. It dealt with traffic signals, marking for pavements, curbs and objects and safety zones in addition to signs.

This work was performed by the Joint Committee on Uniform Traffic Control Devices with the primary purpose of bringing all standards for traffic control devices under one cover and to keep pace with the rapid developments in the art of traffic control. The committee reports:

"The new manual is in strict harmony with the Uniform Vehicle Code and Model Municipal Traffic Ordinance, including the changes adopted by the Fourth National Conference on Street and Highway Safety held in May, 1934. It also takes into account the recommendation of the Sixth International Road Congress,

(Continued on page 20)

California's Uniform Road Sign System Pr

Regulatory Group



Color: Red with White letters Reflectorized

This sign is placed at entrances to "through highways" and "through streets" to stop all traffic entering the highway. This sign is so important and failure to observe its message is so hazardous, that a special shaped *red* sign, unlike any other sign, is defined for this one purpose. The shape and color of this sign is provided by the Vehicle Code. All State Highways are "through highways" and city ordinances designate through city streets.



Color: Black with White letters Reflectorized

Placed to mark the beginning of a "Business District." Section 511 of the Vehicle Code provides a speed limit of 20 miles an hour in any business district, defined as 50% of business houses in 600 feet all on one side or 50% in 300 feet on both sides.



Color: White with Black letters Not Reflectorized

Placed to mark the end of a business district. This is a courtesy sign to inform the motorist he is leaving the speed limit zone.



Color: Black with White letters Reflectorized

Placed to mark the beginning of a "Residence District." Section 511 of the Vehicle Code provides a speed limit of 25 miles per hour in any residence district.



Color: White with Black letters Not Reflectorized

Placed to mark the end of a residence district, defined as 13 dwellings or business houses in ¼ mile on one side or 16 on both sides of highway.



Color: White with Black letters Not Reflectorized

Placed on our highways at suitable locations, to notify traffic of legal speed limit.



Color: Black with White letters Reflectorized

Placed in advance of locations where this message is necessary because of some restriction in the road, such as divisional parking strip, or traffic circle where traffic is divided, or on center piers of overhead structures which divide traffic.



Color: Yellow with Black letters

This is a city sign usually placed at a school or other important pedestrian crossings. Section 560 of the Vehicle Code makes it mandatory for all vehicles to yield the right of way to any pedestrian at a marked cross walk. Placed by cities under permit and removed immediately when not needed. In the case of a school, sign should be in place only for hours of crossing.

des Drivers An Infallible Guide to Safety

Regulatory Group



Color: Black with White letters Reflectorized

Placed at frequent intervals along a three-lane highway to caution traffic not to drive in the center lane except when overtaking and passing a slower moving vehicle.



Color: Black sign with White letters Reflectorized

Placed only where this restriction is absolutely necessary to safeguard traffic and prevent accidents. Failure to obey this restriction is extremely hazardous.



Color: Black with White letters Reflectorized

Placed to caution traffic to remain on the proper side of the road. Used on two-lane pavements for long straight stretches of highway, and frequently on four-lane pavements to restrain traffic from crossing the white center stripe.



Color: White with Black letters Reflectorized

Placed at each end of a bridge or approach to inform traffic not to overtake slower vehicles. This sign is used when the view of traffic on a bridge is obstructed to approaching vehicle.



Color: Black with White letters Reflectorized

Placed approximately 500 feet in advance of crests of blind vertical curves. Section 530 of the Vehicle Code prohibits the passing or overtaking of vehicles when approaching the crest of a grade or upon a curve in the highway. Special double white stripes are painted in the center of the pavement at locations where this sign is installed.



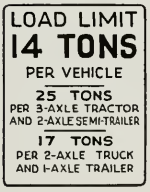
Color: White with Black letters

Used in conjunction with bridge Load Limit signs, and placed on same post with them, where a speed restriction has been placed upon a bridge.



Color: White with Black letters Not Reflectorized

Used only on four-lane pavements to permit fast moving traffic to proceed without unnecessary delay. Section 526 of the Vehicle Code provides that signs may be erected directing slow moving traffic to use a designated lane.



Color: White with Black letters

Placed not closer than 100 feet nor more than 150 feet from each end of a bridge. Used the same as the SPEED LIMIT 15 MILES ON BRIDGE sign. This is a newer type sign, permitting heavier gross loads for certain types of vehicle combinations.

Mt. Palomar Observatory "Highway to the Stars" Opens Next Spring

By E. E. SORENSON, District Construction Engineer

EXTENDING from Rincon on the border of the historic Indian reservation of that name in San Diego County to the site of the $6,000,000 observatory being constructed on top of Mt. Palomar, the first link of the "Highway to the Stars," which bids fair to become one of America's greatest tourist attractions, will be completed by next April.

The State Division of Highways anticipates that this new scenic mountain route will be one of the busiest roads in southern California this summer.

Starting at Rincon it follows State Highway No. 195 for 5.3 miles to the Cu Cu Mesa. The upper portion of 2.8 miles known as the Cu Cu Grade, is now being constructed by the R. E. Hazard Company of San Diego under contract with the Division of Highways. At Cu Cu Mesa the road leaves the State Highway and this second link, 6.8 miles in length, climbs the south slope of Mt. Palomar in wide, easy turns to Crestline. This section will be completed about next May by two county crews working toward each other from camps located at both the top and the bottom of the mountain.

THIRD LINK OPEN

The third link of 1.6 miles extending from Crestline to Iron Springs, has been opened for travel by the county, and there remains only the final finishing to complete it.

The fourth link from Iron Springs to the observatory site at an elevation of 5568 feet, is now nearing completion under the direction of the State Division of Highways, which has contracted the work to Basich Brothers of Torrance, California. This section will be completed in the spring.

Thus the beautiful and scenic "Highway to the Stars" will be open to public traffic over its entire length next summer.

This, however, does not constitute the chief reason for the speed in constructing this difficult road; but rather the necessity for a suitable road over which to transport the massive and heavy equipment to be used in the observatory construction has urged the builders on. Now, thanks to the interest and cooperation of the Federal, State and county governments, "The Highway to the Stars" has passed from a dream to a reality.

Amazing progress has also been made in the construction of the astronomical observatory, which is the largest in the world. Even officers of the California Institute of Technology observatory council express their pleasure at the rapidity of the work which is transforming a mountain plateau into a scene of bustling activity.

ALL STEEL WORK ERECTED

Following are interesting sidelights on the scientific institution which is directing world-wide attention to San Diego County:

Virtually all of the structural steel comprising the base structure for the 200-inch telescope has been erected, the last rivet having been placed during November.

The power house and machine shop is completed. An example of the extreme care being taken to protect the 200-inch mirror is the fact that the two 75-kilowatt generators in the power house, situated more than 300 yards distant from the observatory, are so mounted that they are vibrationless.

STRUCTURES COMPLETED

Completed structures include the 18-inch observatory, five cottages to be occupied by astronomers and scientists, the 1,000,000-gallon water reservoir and 50,000-gallon water tank, both filled to capacity, a 25,000-gallon oil storage tank, a 4000-gallon liquid gas tank, and a dormitory for the permanent Caltech staff of workers numbering 20. Electrically operated pumps will enable the observatory to draw 17,000 gallons of water daily from the springs on the 720-acre site.

The 200-inch observatory is a three-story structure, rising 128 feet with a dome 135 feet in diameter. The top floor will be known as the observing floor, the second will be a mezzanine, while the lower floor will be divided into photographic dark rooms and laboratories, well equipped library, reading room and a compact kitchen.

Two arduous tasks yet await Caltech observatory officials. The first of these will be the transportation, starting in April, of the huge sections of the dome and machinery for the 200-inch observatory. Sections of the dome and rotating machinery weigh 60 tons.

TWENTY TONS OF MIRROR

The second and most exacting task will occur in July, 1939, when the costly mirror, approximating 20 tons has to be moved up the mountain and fitted into position at the bottom of the 65-foot cage in the observatory dome. A special truck will have to be built to transport the massive mirror to the summit of Mt. Palomar and carry the weight safely.

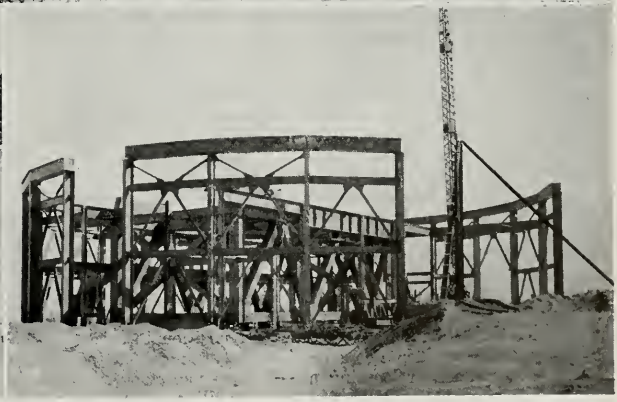
In coming years, countless thousands of San Diegans and visitors probably will ask, as did former President Hoover on his recent visit to Palomar, why High Point, 200 feet higher, was not selected as the site for the 200-inch observatory in preference to the site near the center of the plateau.

Three years of investigation by Caltech scientists disclosed that the air in the center of the plateau is much more stable than at High Point. There is no rapidly fluctuating air currents to stir up the dust, and the atmospheric conditions are in general much better.









Upper—Powder blast breaks down the last obstruction on Palomar Mountain road. Center—Graders opening the last cut on State-constructed portion of highway to Palomar summit. Lower left—Looking toward the observatory site from head of French Valley with steel structure for telescope in center background. Lower right—Steel structure being erected which will support huge telescope of world's greatest observatory.

Accomplishments of Highway Engineering Research Reviewed

By H. S. MATTIMORE, Pennsylvania Department of Highways

(Excerpts from Address at Convention of American Association of State Highway Officials)

A REVIEW of the accomplishments toward betterment in the highway field, attributable to research, can be pointed to with pride by all highway engineers. Although the number actually engaged in what is normally classed as research is a small percentage, the executives, the construction, maintenance and planning engineers, and in fact engineers in all phases of highway work have been a factor in this accomplishment. Needs are discovered in the field and office and presented as research problems. For successful accomplishments this work must be encouraged by executives, and what is the greatest encouragement and incentive to the research worker is that his fellow engineers are ready and anxious to put research findings into practice.

Accomplishments have been made in practically all branches of highway work, and the problem in a brief discussion is to select those findings that are expected to have the greatest effect in improvement in methods and results in the field of planning, construction and operation.

Traffic and transport surveys which are carried on mainly through cooperation of the Bureau of Public Roads and individual states, together with other agencies have placed or will place the highway designer in a position where he has fairly accurate data of the kind and volume of traffic for which he is to plan. This is especially applicable to the redesign of inadequate highways either by partial relocation or widening to take care of an increase in traffic volume. At the same time if accurate data has been secured on traffic accidents consideration will be given to relocating and redesign for safety.

Probably one of the main accomplishments in the construction field has been the advance made on the studies of soils pertaining to their use



H. S. MATTIMORE

as subgrades and road surfaces. The difference in soils used for low cost road surfaces and subgrades under high type pavements has been realized for many years by all highway engineers but detailed methods for testing and classifying soils to determine their quality for road surfacing or subgrades were not available until the last few years.

Intensive work on this problem by research agencies, chiefly among which was the Bureau of Public Roads, has lead to a classification of soils from the standpoint of bearing power and subgrades uses. Having such data available the highway engineer is in a position to ascertain the difference between soils and methods for correcting poor soils so as to better their stability under all weather conditions.

The application of the findings of soil research can be fully conceived from the standpoint that the soil is a foundation and the basis for all road construction. The investigators in this line state that they feel they have just scratched the surface in the soil investigation, but enough has been accomplished to date to indicate the possibility of some corrections in the so-called frost heaves, improvement in drainage, and great possibilities of bettering the subgrades from the bearing power standpoint so as to reduce the depth of some pavement surfaces.

RESEARCH PROVES VALUABLE

These findings from soil research are being applied throughout the United States in construction of stabilized road surfaces either by changing the characteristics of soils or adding materials of a waterproof character from the standpoint of constructing an all year round traffic surface for road of the farm and market type.

One problem on which it is hoped some information will be available in the near future is that of definitely classifying stabilized road surfaces which can be successfully treated with bituminous materials. Engineers who have had experience in the maintenance of earth and gravel roads know that occasionally there are some roads of these types on which bituminous treatments prove detrimental to the stability of the road under wet and freezing conditions. The probable factor involved is that soils containing a large amount of fine material and that of a colloidal nature develop high capillarity. When such soils are waterproofed with bituminous materials the opportunity for evaporation is lost and the accumulation of water leads to failure.

Another line in which soil studies are being applied is toward the correction of slides and lack of stability in earth fills.

A study of soils has lead to further studies on the correction of frost heaves

eventually resulting in the so-called frost boils. The theory in this work is to apply salts to the subgrade to lower the freezing point of the water contained in such soils, thereby eliminating the forming of ice layers the basic cause of such heaves. Some of these reports are available on work which has been carried on in the State of Michigan, and other reports are expected from states now experimenting with this possible corrective measure to reduce or eliminate such heaves.

Vibration for the placing of concrete has been used both in the form of internal and surface vibrators. The internal vibrator is largely used for structures and has proved very efficient as a method to properly place dry concrete in heavily reinforced structures, concrete of greater density is produced and the general evils of overwet concrete are avoided. The internal vibrator is also useful in the placing of concrete around transverse joints of the load transfer character. Vibrator speeds are of some importance and reports are available on the efficiency of vibrators running at different speeds.[1]

Surface vibrators for pavements have been in use for the past several years. Various claims have been made for the concrete so placed and reports are available indicating that such vibration produces an increase in density and possible increase in strength. Naturally the value of all vibrators, whether the internal or surface class, will be a method for laying a drier concrete leading toward the general betterment in durability.

BITUMINOUS BINDERS

A difference in efficiency of the bituminous binders on various types of flexible surfaces has been noted for a number of years but very little has been determined relative to the cause. Studies for the past several years on this problem have indicated that the production of a successful bituminous bound road depended on factors other than securing the proper grade of bituminous material and the proper proportioning of the mix. The work of Riedel and Weber,[2] is quite enlightening on the subject. These investigators in their painstaking manner have carried on extensive research on the adhesiveness of bituminous binders on aggregates, and as a result of their work Dahlberg, another research worker, states: "Experiments carried on by these two men show that the materials in the stone exert more influence on the adhesiveness than did the binder." In accordance with their results stones of acid nature, such as quartzite, granite, synites, etc., furnish poor adhesion with asphalts and tars, while stones of the basic or alkali nature produce good adhesion. This is generally true but exceptions have been noted by the authors, in that some limestones furnish good adhesion while others do not.

The several tests used to determine adhesiveness of binder to different stone are of value in determining the efficiency of the bond within a limited time after mixing and to some extent to determine the relative life of the pavement.

TESTS ARE SUCCESSFUL

These proposed tests are:

1. The water test which consists of shaking a mixture of bitumen and aggregate for one hour with water at varying temperature.

2. The solubility test which is conducted in such a way that the mixture is treated with varying quantities of a solvent and subsequently is subjected for one hour to water at ordinary temperature.

3. The sodium carbonate test in which the mixture is subject to action of sodium carbonate solutions of different concentrations.

The authors state that they have found the results of these tests to check very closely with results in practice. * * * *

SAFETY PARAMOUNT ISSUE

Probably no highway subject has been more discussed than safety. It is a paramount issue to all automobile users and it is affected by practically everything relating to a road—from the general alignment, type of surface, grades, curves, driving conditions, etc. * * * *

The protections of the driver from running off the road is a vital problem especially in countries of rough topography. The guard rails used for this purpose are now subject to some studies on design, but some years ago the idea of a guard rail was to furnish some barrier which was either too light to serve other than warning, or of such a substantial nature that contact with it under many conditions would result in serious injuries or fatalities. Research studies on this problem have indicated that such rails can be designed to take care of average accidents. These research studies have been in the nature of actual trials where vehicles have collided with rails of different types which is followed by the theoretical analysis of general design.

WINTER BRINGS HAZARDS

The use of automobiles during all weather conditions has led to studies of methods to protect the driver against hazards involved in winter driving. Probably one of these worst hazards is ice conditions, when the brake is practically useless, in that the coefficient of friction between the rubber tire and icy road surface is practically zero. Covers of various types have been used for this purpose and maintenance committees of different highway associations have reported on the efficiency of such methods.

It has been found generally that gritty material such as sharp sand, cinders, and stone chips, have corrected this condition by increasing the coefficient of friction. Further studies have shown that the use of a salt in this covering material has a tendency to melt the ice to the extent where the covering material becomes embedded, developing more or less of a rough texture upon refreezing and increasing the braking efficiency, thereby reducing this hazard to a considerable extent. The use of such salts have proved an economic procedure in that investigation in one state has shown that it increases the life of the covering material about three times where the salt has been used, from the standpoint that it is more readily retained on the road or not brushed or swept off with traffic.

The use of salt has been largely confined to calcium chloride until the past several years when sodium chloride has been used in the same manner as calcium chloride and data are being obtained relative to its efficiency and ultimate effect on the road surfaces.

The use of either calcium or sodium chloride straight on the road surface is not good practice. If it is considered necessary to remove the ice by melting, salt solution remaining on the highway should be swept off a concrete road surface as soon as possible as it has been found to be quite detrimental to such surfaces.

(Continued on page 28)

[1] M. O. Withey Proceedings of Highway Research Board, 1935.
[2] Asphalt and Teer 33,677 (1933), 34,209 (1934).

California's Uniform Highway Sign System Described

(Continued from page 13)

held in Washington in 1930, that consideration be given to the more extensive use of symbols.

"The committee, while believing that on a great majority of signs symbols can not safely replace word messages, sees very definite advantages in certain simple symbols, such as those for curves, and has eliminated the former word message from CURVE signs."

The committee urges universal adoption of the sign shapes as basic symbols.

The committee calls attention to the fact that traffic control devices are increasingly necessary for regulating, warning and guiding traffic and points out that adequate but not excessive use of signs to warn of hazards, signs to indicate the applicability of traffic regulations, route markers and destination signs all have great value in facilitating the orderly flow of traffic, as do well-considered pavement and curb markings and islands properly designated and located.

INCREASING NEED FOR CONTROL

In many communities, it is stated, the responsible authorities have not met the problem with scientific analysis but rather by haphazard experimentation, and as a result two fundamental errors have been prevalent. These are (1) placing traffic control devices without adequate study of the possible evil effect produced either there or at other points, and (2) in the case of traffic signals, operation at times not justified by the conditions.

Care is exercised by the Division of Highways to see to it that not too many regulatory or warning signs are installed. Traffic will move with less delay and more safety at many average intersections, curves, hills or other potential accident or congestion points if there is no artificial control. On the other hand, a frequent display of judiciously placed route signs will not lessen their value.

Regulatory signs are placed to notify traffic of provisions in the law which, if disregarded, constitute a misdemeanor. This group contains STOP signs, speed limit signs and signs regulating movement or parking.

The STOP sign has a distinctive red color and octagon shape. All other signs in this group are either square or rectangular in shape and have white backgrounds with black letters, or if reflectorized, black with white letters. Parking signs are generally white with red letters.

Reduced replicas of the more important signs in this regulatory group are shown in the accompanying illustrations. The shape, relative size and color of each sign is reproduced just as it appears to the motorist on the highway.

Warning and guide signs will be considered in forthcoming articles.

New Conejo Grade Route Approaching Completion

WITH construction work nearing completion, the realigned Conejo Grade on the "Ventura Boulevard" route between Los Angeles and Ventura on the Coast Highway is scheduled to be opened to traffic early in March.

This $550,000 highway improvement project will eliminate forty-nine sharp turns on the existing road which for years have been a menace to automobile traffic and the direct cause of numerous serious accidents. Four accidents on the present grade during 1932 and 1933 resulted in the deaths of seven persons and injuries to four others.

FIVE MILE PROJECT

The realignment of the route extends from near Newberry Park southwest of Conejo Summit to Conejo Creek, a distance of approximately five miles. There will be only twelve curves on the relocated highway, all wide and long.

Located in 1912 as one of the first undertakings of the original State Highway Department, Conejo Grade within a few years proved inadequate to accommodate the steadily increasing motor vehicle traffic and the route became more and more hazardous.

In 1929, following completion of the new Coast Highway route between Oxnard and Santa Monica the Conejo Grade was so overcrowded that the Division of Highways realigned some of the worst sections of it, but traffic increased so rapidly that by 1934 it was realized that only a radical relocation of the entire route between Newberry Park and Conejo Creek would solve the growing danger to motorists.

THREE LANES ON GRADE

Realignment presented many technical engineering difficulties. The Division of Highways was confronted with three alternative routes, the "North Route," the "Middle Route" and the "South Route."

The Middle Route, while the most direct, called for a grade somewhat in excess of the allowable 6 per cent maximum grade for the two miles down the west slope of the Conejo Range, but because it offered a shorter distance and fewer curves it was approved.

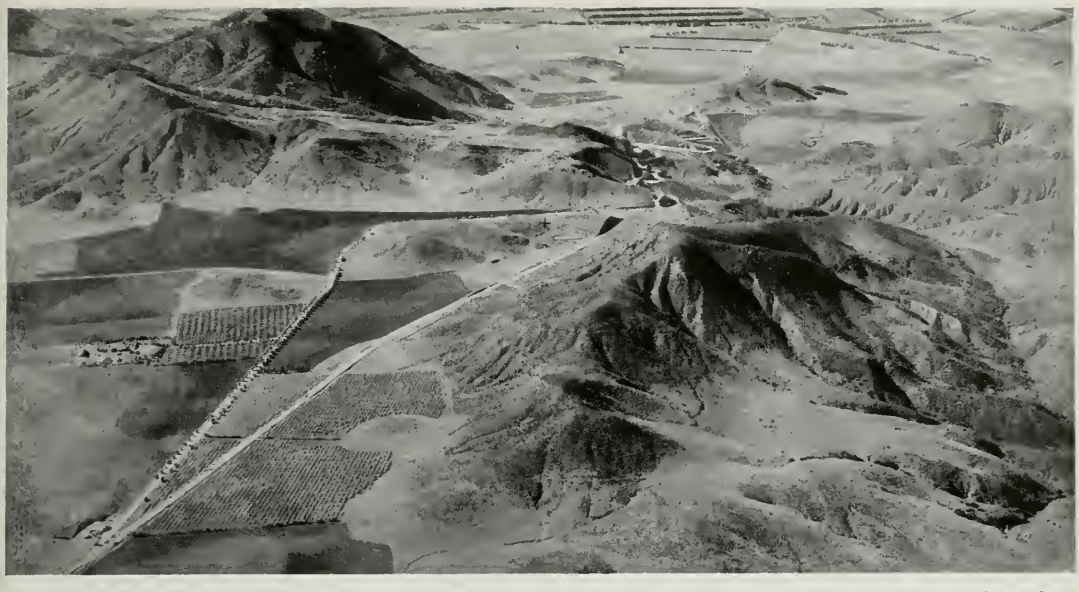
The new highway is a 20-foot concrete pavement constructed on a 46-foot roadbed except down the westerly slope of the range where there will be two 10-foot strips of concrete pavement separated by a 10-foot width of plant-mix oil surfacing. This will provide a 10-foot traffic lane between the concrete strips for vehicles to pass on the grade.

WIDE SHOULDERS PROVIDED

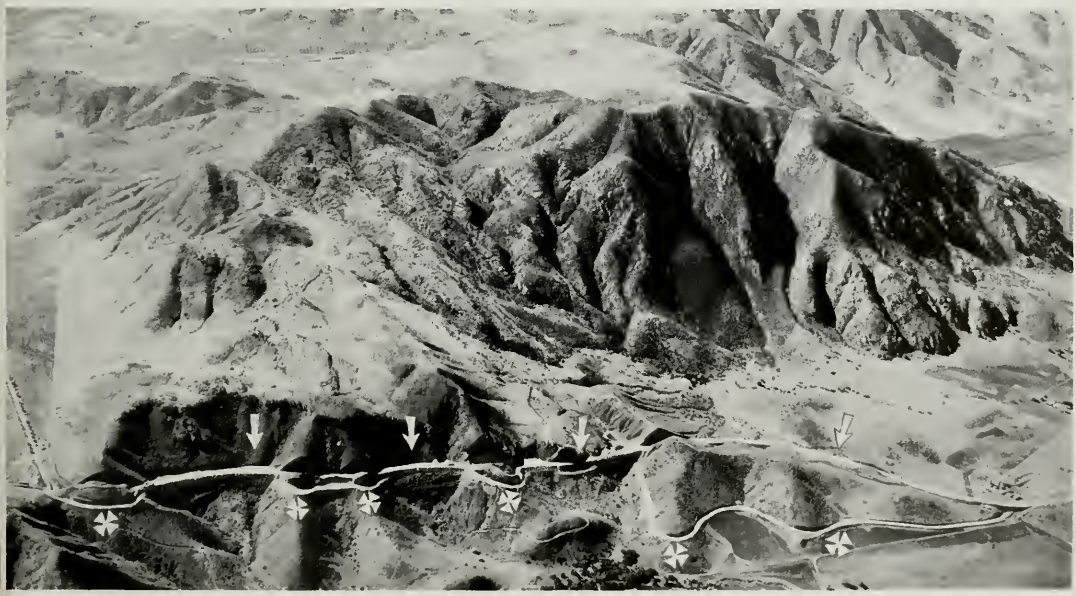
Throughout the length of the project shoulders will be oiled the full width of the roadbed, thus providing ample space for machines to park well off the paved section. Oil and rock surfacing instead of concrete will be used on some of the high fills until the latter have fully settled.

Conejo Creek bridge at the westerly end of the project will be widened to a width of 44 feet to conform to the width of roadbed on each side.

Completion of the Conejo Grade project will eliminate one of the worst traffic hazards on the entire State Highway System.



This aerial view taken on the south side of Conejo Summit and looking west toward Oxnard and Ventura shows existing State Highway and realigned route in left foreground, and the realignment down the grade. Photograph taken by Fairchild Aerial Surveys, Inc.



Broadside aerial view shows how new Conejo Grade eliminates curves on highway between Conejo Summit, extreme left, and Conejo Creek, extreme right. The new route pursues a straight course down through the hills by means of cuts and fills. The new route is indicated by arrows. Curves eliminated are marked by crosses. Photograph by Fairchild Aerial Surveys, Inc.

Improved Drag Finisher for P. C. Concrete Pavement

By H. D. JOHNSON, Assistant Resident Engineer

A RECENT development in the field of finishing Portland cement concrete pavement is a drag float which eliminates all other floats and the skilled labor ordinarily used behind the mechanical spreader, with the exception of the joint finisher and edgerman.

During the past ten years, the riding qualities of our pavements have been greatly improved. This can be attributed to the rivalry among field engineers of the Division of Highways and the cooperation of the District and Headquarters staffs in permitting them to deviate from established methods and to try out new construction ideas.

In 1926, the finishing crew and equipment consisted of one mechanical spreader with its operator and a longitudinal float operated by two men. This float was drawn transversely across the pavement surface with a longitudinal sawing motion, thus cutting off the high spots and filling the depressions. This was an important feature because the riding quality of the pavement was largely dependent upon the operation of this float, as the subsequent finishing consisted of drawing a pliable float transversely across the pavement surface to remove minor inequalities and improve surface appearance. This float was made of a 1″ x 6″ board 16′ long and was equipped with swivel handles on each end. Following the pliable float came the joint finisher and edgerman who finished joints and edges as soon as the set of the concrete would permit.

ONE-MAN FLOAT USED

In 1929, the one-man rib float was introduced and took the place of the pliable float. This released one man so that two ten-foot rib floats were substituted and were used at an interval of approximately 100 feet between floats. Through the use of these rib floats, the fact was established that uneven subsidence occurred during finishing operations, and was accepted as the reason for many rough jobs completed prior to this change in finishing methods. Soon thereafter, these 10-foot rib floats were lengthened to 16 feet.

The 16-foot float was a step toward smoother pavements in that it detected long rolling irregularities not revealed by the ten-foot floats, and this also speeded up finishing operations. Improved mixing and placing equipment with its consequent increase in capacity would have made it imperative to increase the finishing forces if ten-foot floats had been used.

In order to secure the maximum subsidence before finally striking off the surface with a float, it was found necessary to hold back on the final floating until the mass of concrete had obtained its set, with the exception of the surface mortar which still preserved its workability due to previous floating operations. This is now known as retarded finish and is accepted as standard procedure on State work.

Two years later, in 1931, a new float was introduced to take the place of the longitudinal float. This float was an enlarged rib float weighing around 250 pounds and was drawn diagonally back and forth along the pavement in much the same manner as the blade on a road grader. Because of its weight, it was drawn by a truck or horse by means of a cable approximately 100 feet long, traveling on the shoulder along the outside of the header.

This float further aided retarded finishing by working back of the mechanical spreader as far as 400 feet or more, thus preserving the surface mortar in a workable condition, allowing the rib floats to stay back still further, permitting additional subsidence to take place.

INTRODUCED IN 1935

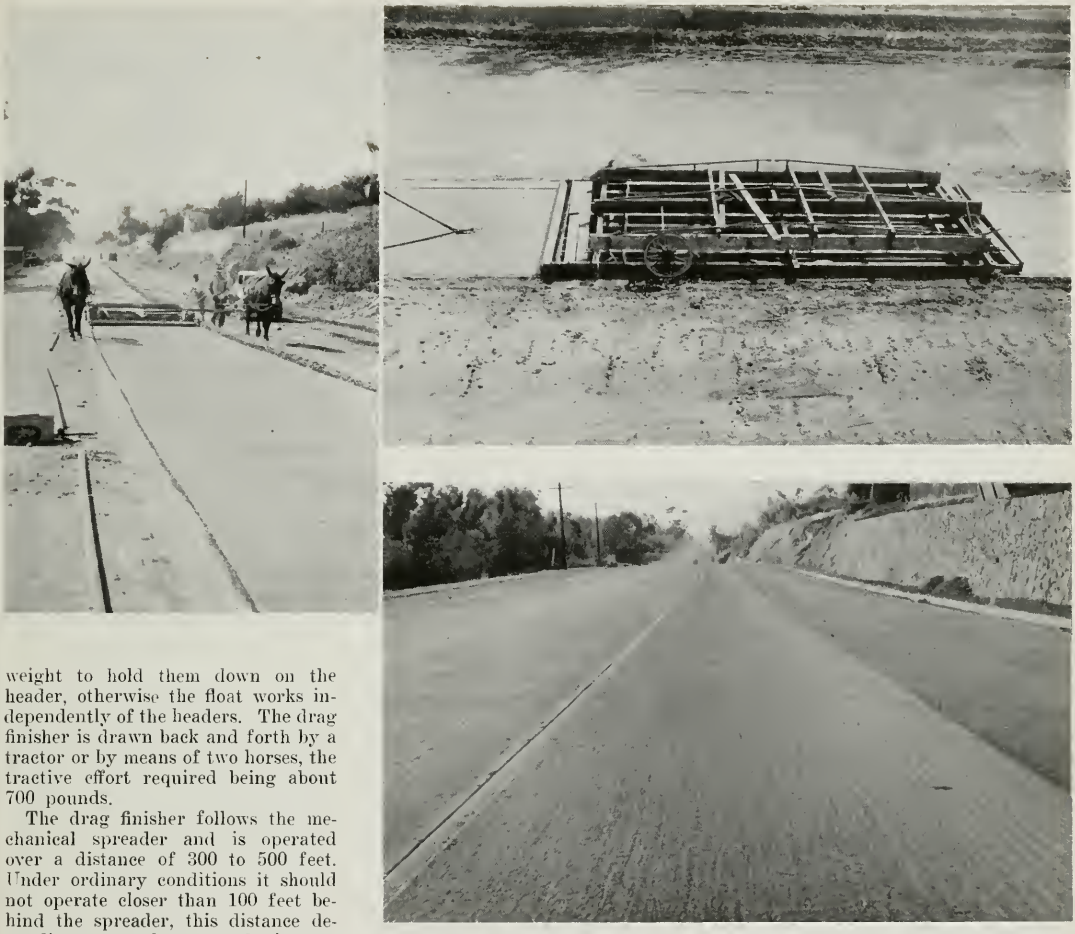
With the approval of the Construction Department, in April, 1935, on Contract 67VC20-47VC24, road VII-Ora-60-C, in Laguna Beach, the drag finisher was first introduced, which works somewhat on the principle of the road plane. It is 20 feet long by 9′-10″ wide, and is drawn back and forth over the surface of the concrete and parallel to the header line. It rides on transverse skids mounted at each end of the drag which has the double function of supporting the machine and striking off the concrete to a plane surface. Between these end skids, a series of cutting blades are set at an angle of 3° with the header line similar to the blades of a subgrader. This blades the mortar into three windrows which are then struck off and smoothed by the rear skid. A roller attached ahead of the front skid brings up the mortar and rolls down the surface rock.

The machine is guided by double-flanged wheels on one side, which act as guides and carry only enough

Highway Creed Adopted by AAA

We must have roads suitable and adequate for the movement of modern motor traffic with safety. There must be multiple lane highways with opposing traffic streams divided. They must be free and not toll roads.

These roads must, in every instance, be predicated on traffic needs, and the State highway planning surveys should point definitely to where needs exist. They must embody every possible safety aid. We must not overlook the growing need for an adequate system of secondary roads and arterial routes through cities. Every State should have a long-range program of development and the administration and conduct of such a program should be divorced entirely from politics.



Upper—Close-up view of new type drag finisher being used in road construction by Division of Highways. Upper left—Showing operation of mule-drawn float which reduces cost of highway finishing. Lower—Appearance of highway after use of drag finisher.

weight to hold them down on the header, otherwise the float works independently of the headers. The drag finisher is drawn back and forth by a tractor or by means of two horses, the tractive effort required being about 700 pounds.

The drag finisher follows the mechanical spreader and is operated over a distance of 300 to 500 feet. Under ordinary conditions it should not operate closer than 100 feet behind the spreader, this distance depending upon the atmospheric conditions and the type of concrete mix used. This float has many advantages over other methods now in use because it reduces the human element to a minimum. It reduces the labor cost of finishing and does better work under adverse conditions. Experiments indicate that this machine could easily handle the capacity output of two one-yard pavers.

QUICKLY RESTORES SURFACE

One instance in which this drag finisher really proved its worth occurred after a heavy shower which ruined the surface of approximately 700 feet of freshly finished surface. Ordinarily the repair of this surface would require two hours of work on the part of the finishing crew and two hours lost time for the mixer. With the drag finisher, it required approximately 15 minutes to correct the damage and the only additional work required was the refinishing of joints and edges.

The surface appearance of the finished pavement when using the drag finisher differs from the ordinary finish in that the float marks are longitudinal instead of transverse. It gives a better surface because it reduces the element of side skidding and the longitudinal marks are more pleasing to the eye than are the float scars on the average job.

The Construction Department desires to add that the riding qualities of this experimental section are not quite up to the average for this season's work on concrete paving. However, it is believed that a further perfection of this device is possible which will eventually lead to a consistent quality of finish which at least is equal to the present day average surface.



The United States Bureau of Reclamation continued work during the month on the preparation of plans necessary for starting construction on the initial units of the Central Valley Project. Preliminary investigations and exploration work have been continued at Kennett and Friant dam sites as has the survey along the Contra Costa Conduit and Friant-Kern Canal. Appraisers are working in the field evaluating lands and necessary rights of way to be acquired. The Division of Water Resources is conducting surveys and making investigations in the San Joaquin and Sacramento valleys preliminary to the acquisition of properties and water rights and the preparation of agreements necessary for the construction of the project.

During the month of December, the Consulting Board of the United States Bureau of Reclamation consisting of Charles A. Paul of Dayton, Ohio, Dr. F. W. Durand of Stanford University, Dr. Charles P. Berkey of Columbia University, and R. V. Meikle of Turlock, California, met with the Consulting Board of the Water Project Authority of California, consisting of F. C. Herrmann of San Francisco, B. A. Etcheverry of the University of California, Dr. George D. Louderback of the University of California, and J. D. Galloway of San Francisco, for a study and inspection of the dam sites and amount of storage required on the Sacramento River for the Central Valley Project.

IRRIGATION DISTRICTS

At the request of La Mesa, Lemon Grove and Spring Valley Irrigation District, a field inspection and report was made on the proposed reconstruction of El Monte Pumping Plant. The district and the city of San Diego have recently completed a steel pipe line leading from El Capitan Reservoir and reconstruction of the El Monte plant will be necessary to link this source of supply with the district's distribution system.

Investigation of the proposed power construction program in Imperial Irrigation District is now in progress. In addition to a proffered loan of $700,000 from the Rural Electrification Administration, for construction of transmission and distribution lines, a tentative allotment of $2,760,000 has been made by the Public Works Administration which would provide for construction of hydro-electric plants on the All-American Canal.

Favorable reports were submitted to the boards of supervisors of Fresno and Tulare counties in connection with the oraganization procedure of Orange Cove and Ivanhoe Irrigation districts which plan to secure their water supply from the Friant-Kern Canal of the Central Valley Project.

DISTRICTS SECURITIES COMMISSION

At the regular monthly meeting of the commission held in San Francisco, December 11, 1936, the request of Lindsay-Strathmore Irrigation District for approval of a proposed compromise agreement effecting settlement of water litigation pending in the superior court of Tulare County was granted. Following this approval, a stipulated judgment was signed by Judge E. W. Owen of Kern County on December 18, 1936, which brought to an end the famous water suit between Tulare and Lindsay-Strathmore Irrigation Districts that has been in the courts for more than twenty years.

FLOOD CONTROL AND RECLAMATION

Extensive repairs have been made on Bridge E-2, consisting of reinforcing the piling and renewing deck timbers. A dragline excavator has been operating during the entire period cleaning the drainage canals tributary to Pumping Plant No. 3.

In the Sacramento by-pass the work of installing concrete and rock erosion protection along the south levee and near the weir has been completed.

All of the Sacramento Flood Control Project units for the maintenance of which this office is responsible are in excellent condition to withstand floods.

Relief Labor Work

A relief labor crew of 20 men has been engaged during this period in clearing the flood channel of the Feather River north of Marysville.

A transient relief labor camp has been established by the State Relief Administration at Camp No. 7 in Reclamation District No. 1500 in Sutter Basin. Approximately 90 men are now available for labor and are engaged in clearing the Tisdale by-pass under the direction of this division and along the river levee of Reclamation District No. 1500. Tools, transportation and supervision are being furnished by this office for the work in Tisdale by-pass.

The War Department has continued activity in the construction of bank protection works on the Sacramento River under the State-Federal cooperative program of June, 1932. The program, involving an expenditure of approximately $500,000, is at this time about 70 per cent complete. While there has been a slight raise in the river above the summer low stage, this has resulted in no interference with the work.

Sacramento Flood Control

The new Sacramento River levees constructed by the U. S. War Department in cooperation with the Reclamation Board, on both sides of the river extending from Colusa to Princeton, have been completed. Therefore, at this time the levees on the Sacramento River contemplated under the project are complete, with the exception of a few small sections requiring raising on set-back. The entire project is now in excellent condition to care for floods.

SUPERVISION OF DAMS

Application was filed on December 17, 1936, for approval of the Atascadero Park Dam in San Luis Obispo County, owned by the county of San Luis Obispo. The dam is 12 feet in height and has a storage capacity of 150 acre-feet. It is used for recreation purposes.

Application was filed on December 4, 1936, for the enlargement of the Danhauser Dam in Modoc County. The dam is owned by P. C. Weber. The increase in height is approximately two feet and the increase in storage capacity about 350 acre-feet. The estimated cost of the work is $800.

Construction is being actively continued on Cajalco Dam of the Metropolitan Water District, San Gabriel Dam No. 1 of the Los Angeles County Flood Control District; O'Shaughnessy Dam of the city of San Francisco; Grant Lake and Long Valley dams of the city of Los Angeles, and White House Creek Dam located in San Mateo County.

Work has been completed on the West Valley Dam of the South Fork Irrigation

District in Modoc County; Judson Dam of the Metropolitan Water District in San Diego County; Mono Creek Dam of the City of Santa Barbara; and Eaton Wash Dam of the Los Angeles County Flood Control District.

Repair work to the Lake Hodges Dam of the city of San Diego is practically completed. Work on the Mad River Dam of the city of Eureka has been discontinued as had the construction work at the Arcata Dam of the city of Arcata.

WATER RIGHTS

Supervision of Appropriations of Water

During the month of November there were 19 applications received to appropriate water; 9 were denied; 16 were approved; 10 permits were revoked and 3 licenses were issued.

Among the applications which were received was one by California Water and Telephone Company to appropriate from Tia Juana River in San Diego County for irrigation and domestic purposes at a cost of $350,000 and an application by the Indian Valley Mutual Water Company to appropriate 185,700 acre-feet by storage on North Fork of Cache Creek in Lake County for irrigation and domestic uses upon 60,000 acres now supplied by Clear Lake Water Company.

During the month reports were received from 344 permittees and 82 licensees, which reports are under study.

Water Distribution

Reports covering water master service in the following districts for the current season will be prepared during the winter: Owl, Soldier, Emerson, Cedar, Deep and Mill Creek Water Master districts (In Surprise Valley, Modoc County); New Pine, Davis and Franklin Creek Water Master districts (in Goose Lake Valley, Modoc County); South Fork of Pit River, Pine Creek, Hot Springs Valley and Big Valley Water Master districts (in Modoc and Lassen counties); Shasta River Water Master District (in Siskiyou County); Hat, Burney and Cow Creek Water Master districts (in Shasta County).

SACRAMENTO-SAN JOAQUIN WATER SUPERVISION

During the past month the activities of this office have been confined to office work in making ready the data to publish a report showing the amount of water diverted from and returned to the streams in the Sacramento-San Joaquin territory. The report will also show the amount of land irrigated, the flow in the stream channels and the rate of advance and retreat of salinity in the delta.

During the month there has been no increase in the flow in the valley streams. The flow of the Sacramento River at Sacramento is about 5000 second-feet.

There has been no appreciable change in salinity conditions in the delta. Sampling is being done at certain key stations throughout the delta.

W. V. Darling Is Honored on Eve of Retirement

Retiring after 18 years as an official of the Maintenance Department of the State Division of Highways, W. V. Darling, superintendent of highways in the west end of Riverside County, was tendered a testimonial dinner in the Tetley Hotel in Riverside on the night of December 29 by members of the staff and maintenance crews of District VIII.

The affair was in the nature of a surprise party and was attended by sixty of the personnel of the maintenance department of the district. Mr. Darling's retirement was mandatory under the State age limit law.

Mr. Darling entered State service in 1918 when he resigned as superintendent of streets of Riverside to join the forces of the Division of Highways.

E. Q. Sullivan of San Bernardino, District Highway Engineer, presided at an after dinner program during which Fred Brouse, one of the five foremen in Mr. Darling's jurisdiction, presented the guest of honor with a radio, a gift of the department personnel.

SPEAKERS EXPRESS REGRET

Speakers expressed regret at Mr. Darling's enforced withdrawal from State service. J. E. Stanton of San Bernardino, District Maintenance Engineer of the Division of Highways, said that California was losing a valuable highway authority in Mr. Darling, who has a wide reputation as a highway maintenance expert, and who pioneered in bituminous road surfacing.

Former State Highway Commissioner Frank Tetley of Riverside recalled many years of friendship and association with Mr. Darling and voiced his regret at the latter's retirement.

Mr. Sullivan related that he first met Mr. Darling in 1913 when he went to Riverside to work with him in the construction of the reinforced concrete thin-slab bridge over north Main Street in Riverside, a structure still in use. Mr. Sullivan said that recently he had occasion to write an article for a magazine concerning this bridge and found that it is one of the oldest of such jobs in the United States, a tribute to its builder, Mr. Darling.

Born in Maine, Mr. Darling passed his young manhood in New England and then moved west, engaging in farming and lumbering in South Dakota and Washington. He came to California in 1895 and two years later went to Riverside. In 1902 he became associated with the city street department of Riverside and in 1909 became Superintendent of Streets, a post he filled until he entered State service in 1918.

COOPERATIVE SNOW SURVEYS

All work on this project during the past month has been routine office procedure necessary to bring up to date all data pertaining to the precipitation and run-off experienced during the past year; this is preparatory to resuming the publication of monthly snow survey bulletins beginning next February first.

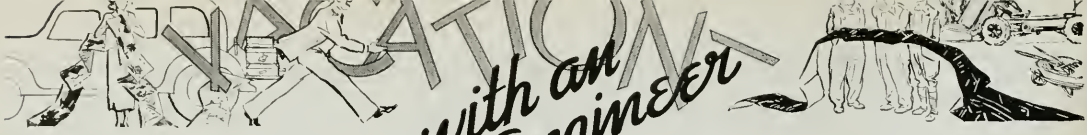
Actual discharge figures of all mountain streams for the water year ending September 30th have been received from the Water Resources branch of the U. S. Geological Survey while records of reservoir storages and stream diversions during the same period have been supplied by the various organizations exercising artificial control over the run-off from the many mountain watersheds.

With these data available, the figures of full natural flow for the past year are now being compiled. Those completed to date show a very close agreement with the forecasts published in the 1936 April and May bulletins. A tabulation showing a comparison of the forecasted figures with those of the historical run-off actually realized will be published as soon as the compilations have been completed for all watersheds.

Ten sets of snow measuring equipment have been received from the Division of Irrigation, Bureau of Agricultural Engineering, U. S. Department of Agriculture and these are being distributed to those organizations which this winter are beginning their first year of cooperative work with the California Cooperative Snow Surveys.

The bridge terminal in San Francisco which will accommodate railway traffic over the Bay Bridge has been designed to care for the anticipated 35,000 000 commuter trips a year. The building will be 55 feet high and 900 feet long.

Some of the steel sections built into the Bay Bridge towers weigh as much as 78 tons and the average is about 50 tons. Specially built railroad cars were required to transport the heavier sections to the waterfront to be loaded on barges.



VACATION with an Engineer

BY GLADYS CRAIG POTTER,
Wife of C. A. Potter, Resident Engineer, District II.

WHEN the tired business man wants to lighten his cares
He goes to a snappy show,
And forgets about work and the market reports
As he sits in the very front row;
While a doctor, they say, on a vacation bound,
Will hie himself off to the hills,
Where he'll fish and he'll hunt to his heart's content,
Forgetting his overdue bills;
And a lawyer may pass his holiday
Inspecting the bathing beauties,
As he lies in the sand at a beach resort
And forgets his judicial duties.

BUT an engineer, let me say right here,
Has a very different code!
With his two weeks pay from the State Highway
He will head for the open road!
So don't envy the life of an engineer's wife,
Ye maidens of high social station,
For here's what you'll get when you go on a trip
With an engineer on his vacation:

YOU'LL start bright and early because, don't you see,
He's not used to sleeping late.
And you'll rush through your breakfast and make up your face,
'Cause an engineer hates to wait;
And then when you're out on the wide white road,
Speeding toward your goal,
You'll come to a stretch where they're shooting oil
And the traffic is under control.
Then you'll sit in the car in the broiling sun
With nothing at all to do,
While your husband "talks shop" with the maintenance man,
And at least three patrols go through!



AND when you're at last on your way again
He'll seek your attention to fix
By explaining how smooth is the surface you get
With a D. G. and bitumen mix.
By this time you're thirsty and hot and tired,
So you say, "What about some beer?"
But he passes each stand for the next ten miles
'Cause a new drinking fountain is near,
And he wants to inspect the rubble wall
And the way that the pipes are laid—
So you fill up on water that spills down your dress
And ruins your new pumps of black suede.

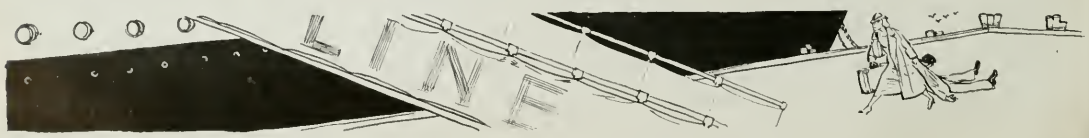
ALONG about noon you look for a sign of The Inn
That your friends have all told you about:
"They serve the best luncheon that ever was cooked,
"And, my dear, you should taste their broiled trout!"
But about this same time, as you go up the grade,
You come to a contractor's camp.
And your engineer-husband brakes down with a shout
Of, "There's good old Sammy, the scamp!"
Then he's pounding the back of a gray haired man
As though he were not quite sane,
And saying, "Why Sam, what the hell do you mean,
"Going into the contracting game?"



YOU wait in the car while they talk of old times
When they worked on a location party,
And he finally remembers he's got you along
So he brings over Sam, very hearty,
Who says, "What's the matter with you and your wife
Having lunch in the cook shack with me?"
So you eat a beef stew with hot coffee and pie
While you long for broiled trout and iced tea!
And when finally they put up the layout sheets
And you're once more on your way,
He regales you with stories of S. I. life
For the rest of the long summer day.

NEXT morning you come to a six mile stretch
Which he built back in thirty-two,
And he tells you in detail just how it was done,
From the time that the line was run through
And the first stake punched and the first dirt moved,
And the road built up to grade,
To the hour when the headwalls were polished up
And the last yard of pavement laid!
You try all in vain to point out the beauties
Of village and city and field.
His only reply is to give a long sigh
And say, "This piece should really be sealed."
He admires a deep cut or the arch of a bridge,
He sees nothing else but the highway;

HE can never be urged to turn off and explore
Some interesting-looking old by-way.
So you learn about tangents and angles and curves,
You get quite a good education,
And that's about all that you get when you go
With an engineer on his vacation.
But when you near home, on the last weary mile,
You are struck with a very bright notion!
And "Darling," you say, in your most honeyed way,
"Next year for our trip let's go on a ship!"
(For, thank God, there's no roads on the ocean!)



Bids and Awards for October-December, 1936

ALAMEDA COUNTY—On Castro Hill about 0.4 miles, existing roadbed to be graded and widened with plant-mix surfacing. District IV, Route 5, Section B. Independent Constr. Co., Ltd., Oakland, $11,360; Frank Embleton, Albany, $11,975; E. A. Forde, San Anselmo,, $10,365.50; Lee J. Immel, Albany, $12,097.30; W. H. Larson, Oakland, $10,454. Contract awarded to Jones E. King, Hayward, $8,435.

EL DORADO COUNTY—At Webber Creek, about 1.5 miles south of Placerville, an existing steel bridge to be removed and a timber bridge to be constructed. District III, Route 65, Section C. M. A. Jenkins, Sacramento, $6,127; F. H. Neilson, Orland, $6,063. Contract awarded to Donald Edwin Morton, Placerville, $5,989.55.

HUMBOLDT COUNTY—Between Beatrice Overhead and Eureka about 5.2 miles in length to be graded and surfaced with gravel base and screen gravel. Widen existing concrete bridge. District I, Route 1, Section G. Hemstreet & Bell, Marysville, $185,742.30; Hanrahan Company, San Francisco, $171,-798.50. Contract awarded to N. M. Ball Sons, Berkeley, $152,342.40.

IMPERIAL COUNTY—Between Mulberry Avenue and Calipatria, 6.0 miles to be graded, surfaced with gravel and treated with liquid asphalt and a timber trestle to be constructed. District XI, Route 187, Section D. V. R. Dennis Coust, Co., San Diego, $74,600; B. G. Carroll, San Diego, $69,928; Dimmitt & Taylor, Los Angeles, $75,779; J. E. Haddock, Ltd., Pasadena, $84,012; R. E. Campbell, Los Angeles, $94,-730; Oswald Bros., Los Angeles, $76,233. Contract awarded to R. E. Hazard & Sons, San Diego, $58,459.

INYO COUNTY—Between 3.5 miles east of Saline Valley Road and Panamint Sink about 17.6 miles to be graded. District IX, Route 127, Sections E, F. D. W. Thurston, Los Angeles, $197,254.75; Basich Bros., Torrance, $238,749; Morrison-Knudson Co., Inc., San Francisco, $188,949; A. Teichert & Son, Inc., Sacramento, $217,728.50; Isbell Construction Company, Reno, Nevada, $219,-905.50. Contract awarded to Peninsula Paving Co., San Francisco, $168,125.50.

KERN COUNTY—Bridge over Calloway Canal, 2 miles west of Bakersfield. District VI, Route 58, Section L. Wm. C. Horn Co., Pomona, $11,960; R. P. Moore, Fresno, $10,943; Opperman & Co., Bakersfield, $10,258; Griffith Co., Los Angeles, $11,612; F. O. Bohnett, Campbell, $11,800; D. A. Loomis, Glendale, $10,622; F. A. Greenough, Bakersfield, $11,510. Contract awarded to Carl Ingalls, Inc., Bakersfield, $7,637.

LOS ANGELES COUNTY — Marengo Street in Los Angeles, between Cornwell Street and Lord Street, 0.6 miles to be graded and paved with asphalt concrete. District VII, Route 4, Section L.A. Geo. R. Curtis Pavg. Co., Los Angeles, $65,218; P. J. Akmadzieh, Los Angeles, $67,528; Southwest Paving Co., Roscoe, $66,923; United Conc. Pipe Corp., Los Angeles, $67,-108; Griffith Co., Los Angeles, $73,627; W. E. Hall Co., Alhambra, $65,389. Contract awarded to Oswald Bros., Los Angeles, $57,-412.

LOS ANGELES COUNTY—Rosemead Blvd. between San Gabriel Blvd. and Ramona Blvd., 3.5 miles plant-mixed surfacing to be applied to shoulders. District VII, Route 168. Sections B, C. Contract awarded to L. A. Decomposed Granite Co., Los Angeles, $10,780.

LOS ANGELES COUNTY—At Rosemead Ave., 2 miles west of El Monte, a reinforced concrete girder bridge to be constructed across Rio Hondo. District VII, Route 168, Section C. Donald Atkinson, San Francisco, $72,185; Griffith Co., Los Angeles, $82,189; Byerts & Dunn, Los Angeles, $75,555; J. E. Haddock, Ltd., Pasadena, $87,557; Oscar Obers, Los Angeles, $72,442; T. A. Allen Construction Co., Los Angeles, $67,300; John Strona, Pomona, $66,555. Contract awarded to Carlo Bongiovanni, Hollywood, $65,843.

LOS ANGELES COUNTY—On Atlantic Ave., between 68th Street in Long Beach and Olive Street, 0.7 miles to be graded and paved with P.C.C. District VII, Route 167, Section L. Bch. and A. Basich Bros., Torrance, $78,940; Griffith Co., Los Angeles, $71,325.50; Matich Bros., Elsinore, $75,692; C. R. Butterfield, San Pedro, $83,414; J. F. Knapp, Oakland, $99,120; J. E. Haddock, Ltd., Pasadena, $75,.217.50; Oswald Bros., Los Angeles, $76,289.50. Contract awarded to United Concl. Pipe Corp., Los Angeles, $71,284.20.

LOS ANGELES COUNTY—At the junction of Whittier and San Gabriel boulevards, about 0.3 mile to be graded and paved with Portland cement concrete. District VII, Route 168, Section B. Kovacevich & Price, Southgate, $28,500. Contract awarded to J. E. Haddock, Ltd., Pasadena, $25,110.75.

LOS ANGELES COUNTY—Between Wilmington Boulevard and Alameda Street in the city of Los Angeles, 1.6 mile to be graded and paved with asphalt concrete and plant-mixed surfacing. District VII, Route 60. P. J. Akmadzieh, Los Angeles, $173,-315; Sully-Miller Contracting Co., Long Beach, $188,020; Geo. R. Curtis Paving Co., Los Angeles, $179,941; Southern California Roads Co., Los Angeles, $188,123; Griffith Co., Los Angeles, $182,793; Oswald Bros., Los Angeles, $176,447; R. E. Campbell, Long Beach, $190,759. Contract awarded to United Concrete Pipe Corporation, Los Angeles, $156,859.

MENDOCINO COUNTY—Between Eleven Oaks and Willits, 1.1 mile to be graded and surfaced with screened gravel on gravel base and reinforced concrete bridge to be constructed. District I. Route 1, Section E. Hemstreet & Bell, Marysville, $61,813; C. W. Caletti & Co., San Rafael, $66,709. Contract awarded to A. Soda & Son, Oakland, $53,260.

MONTEREY COUNTY—On Market St. in Salinas between Lincolu St. and the west city limits, 0.9 mile to be graded and surfaced with crusher run base and plant-mixed surfacing. District V, Route 118. A. J. Raisch, San Jose, $29,575. Contract awarded to Granite Construction Co., Ltd., Watsonville, $28,889.

MONTEREY COUNTY—At the Molera Ranch, about 26 miles south of Monterey, a reinforced concrete water tank to be constructed. District V, Route 56, Section F. E. T. Lesure, Oakland, $3,955; F. O. Bohnett, Campbell, $3,419. Contract awarded to M. J. Murphy, Inc., Carmel, $2,417.98.

MONTEREY COUNTY — Construct a steel beam bridge with concrete deck across Castro Canyon, about 35 miles south of Monterey, consisting of one 51ft. span, two 50-ft. spans and two 42-ft. spans. District V, Route 56, Section E. Lindgren & Swinerton, Inc., Oakland, $45,737; A. H. Vogt Co., Inc., San Francisco, $43,552; Peter J. McHugh, San Francisco, $43,681.75; F. O. Bohnett Co., San Jose, $44,512; R. R. Bishop, Long Beach, $46,521; Frank C. Amoroso & Sons, San Francisco, $51,147. Contract awarded to E. T. Lesure, Oakland, $42,517.75.

NEVADA and PLACER COUNTIES — Between one-half mile west of Soda Springs and Donner Summit, 3.7 miles to be graded and paved with Portland Cement concrete and a parking area to be constructed near Donner Summit Bridge. District III, Route 37, Sections B, C, G. A. Teichert & Son, Inc., Sacramento, $233,228; Basich Brothers, Torrance, $234,621; United Concrete Pipe Corporation, Los Angeles, $331,329. Contract awarded to Fredericksen & Westbrook, Lower Lake, $225,380.50.

NEVADA COUNTY—Between Donner Grade and east end of Donner Lake, two and five-tenths (2.5) miles, to be graded and surfaced with plant-mix surfacing on crusher run base. District III, Route 37, Section C, D. A. Teichert & Son, Inc., Sacramento, $120,634. Contract awarded to Pacific States Construction Co., San Francisco, $118,588.

ORANGE COUNTY—Between Carolina Ave. and Yorba Linda, 3.6 miles to be graded and surfaced with plant-mixed surfacing and timber trestle bridge to be constructed. District VII, Route 176, Section A. C. R. Butterfield, San Pedro, $112,205; United Concrete Pipe Corp., Los Angeles, $112,562; Dimmitt & Taylor, Los Angeles, $106,736; Oswald Bros., Los Angeles, $101,-626; J. E. Haddock, Ltd., Pasadena, $101,-374; R. E. Campbell, Los Angeles, $119,607; A. S. Vinnell Co., Los Angeles, $96,148. Contract awarded to C. O. Sparks & Mundo Engineering Co., Los Angeles, $91,115.

ORANGE COUNTY—Between Dowling Avenue and Linda Vista Street, 1.2 miles to be graded and surfaced with plant-mixed surfacing and a timber bridge to be constructed. District VII, Route 175, Section B. United Concrete Pipe Corp., Los Angeles, $49,107; Geo. R. Curtis Paving Co., Los Angeles, $44,998; C. R. Butterfield, San Pedro, $44,457; R. E. Campbell, Los Angeles, $50,413; Oswald Bros., Los Angeles, $42,191. Contract awarded to A. S. Vinnell Co., Los Angeles, $37,598.50.

RIVERSIDE COUNTY—At Snow Creek, 1.0 mile to be graded, surfaced, and a reinforced concrete bridge to be constructed. District VIII, Route 187, Section D. Geo. Herz & Co., San Bernardino, $137,097; B. G. Carroll, San Diego, $140,524; R. E. Campbell, Los Angeles, $135,672; Dimmitt & Taylor, Los Angeles, $139,894; United Concrete Pipe Corp., Los Angeles, $137,199. Contract awarded to Oswald Bros., Los Angeles, $121,600.

SACRAMENTO COUNTY—4 miles and 2.5 miles south of Brighton and 4.5 miles east of Perkins, concrete box culvert, 2-span timber bridge, and 3-span concrete bridge to be constructed. District III, Routes 54 and 98, Section A. F. O. Bohnett Co., Campbell, $14,996. Contract awarded to Lord & Bishop, Sacramento, $13,153.

SAN BERNARDINO COUNTY—Water supply well to be drilled at the Camp Angelus. District VIII, Route 190, Section E. D. A. Beck & Sons, Inc., Alta Loma, $870.

SAN BERNARDINO COUNTY—In Colton at Maple and 7th Streets, a steel and concrete pedestrian overhead crossing to be constructed. District VIII, Route 43, Section Col. E. S. and N. S. Johnson, Pasadena, $10,458.50; D. A. Loomis, Glendale, $10,072.20. Contract awarded to Geo. Herz & Co., San Bernardino, $9,302.80.

SAN BERNARDINO COUNTY—Between Colton and San Bernardino-Riverside County line, 2.9 miles, palm trees to be removed and reset. District VIII, Route 43, Section F,Col. R. W. Hamsher, Los Angeles, $3,944; J. A. Brodrich, Los Angeles, $8,285. Contract awarded to P. E. Carr, San Bernardino, $3,081.

SAN BERNARDINO COUNTY—Hinkley Maintenance Station, a water supply well to be drilled. District VIII, Route 58, Section C. Contract awarded to D. A. Beck & Sons, Alta Loma, $757.

SAN BERNARDINO COUNTY — At Sand Creek, about 3 miles east of San Bernardino, a reinforced concrete box culvert to be constructed. District VII, Route 190, Section C. Peter J. McHugh, San Francisco, $9,195.80. Geo. Herz & Co., San Bernardino, $7,975.50.

SAN DIEGO COUNTY—Between 2.5 miles east of Rincon and Rancho Cuca, 2.8 miles to be graded and road mix surface treatment applied. District XI, Route 195, Section D. Miracle Co., San Diego, $47,-816; V. R. Dennis Const., San Diego, $34,533; B. G. Carroll, San Diego, $42,909; A. S. Vinnell Co., Los Angeles, $33,271; Martin Bros. Trucking Co., Long Beach, $40,049; Dimmitt & Taylor, Los Angeles, $59,671; C. F. Robbins, Los Angeles, $41,-338.60; Basich Bros., Torrance, $42,644. Contract awarded to R. E. Hazard & Sons, San Diego, $32,921.10.

SAN DIEGO COUNTY—Main Street between Division Street and 32d Street in the city of San Diego. 1.1 mile to be graded and paved with concrete and plant-mixed surfacing. District XI, Route 2. David H. Ryan, San Diego, $99,466; R. E. Hazard & Sons, San Diego, $101,191; Daley Corp., San Diego, $109,849; Basich Bros., Los Angeles, $99,574; Griffith Co., Los Angeles, $101,897. Contract awarded to V. R. Dennis Construction Co., San Diego, $96,-796.

SAN DIEGO COUNTY—Between Oceanside and Las Flores Underpass, 7.9 miles to be graded and paved and bridges to be constructed. District XI, Route 2, Section Oen. C. D. V. R. Dennis Const. Co., San Diego, $435,906; Jahn & Bressi Const. Co., Inc., Los Angeles, $416,914; D. W. Thurston, Los Angeles, $553,562; Basich Bros., Torrance, $430,648; Griffith Co., Los Angeles, $431,545; David H. Ryan, San Diego, $423,503; Hueser & Garnett, Glendale, $428,234; J. E. Haddock, Ltd., Pasadena, $457,630; Oswald Bros., Los Angeles, $441,613. Contract awarded to Wood & Bevanda, Stockton, $399,157.50.

SAN MATEO COUNTY—Between San Mateo and Redwood City, 5.6 miles to be graded and paved with asphalt concrete. District IV, Route 2, Section S. M. Bmt. B. S. Car, Redwood City. A. Teichert & Son, Inc., Sacramento, $395,130; Hanrahan Company, San Francisco, $354,838; David H. Ryan, San Diego, $384,483; Union Paving Co., San Francisco, $348,737; Eaton and Smith, San Francisco, $393,364; Peninsula Paving Co., San Francisco, $344,259. Contract awarded to Basich Bros., Torrance, $340,785.

SANTA BARBARA COUNTY—Bridge across Zaca Creek, about 9 miles south of Los Alamos, to be widened, District V, Route 2, Section C. R. R. Bishop, Long Beach, $6,432.50; L. A. Brisco, Arroyo Grande, $6,382.50; M. G. Torson Constr. Co., Long Beach, $7,712. Contract awarded to Robert D. Paterson, Santa Barbara, $5,-388.50.

SANTA BARBARA COUNTY—In the city of Santa Barbara within the grounds of the proposed State Teachers College, 0.3 miles to be graded. Guerin Bros., San Francisco, $17,520.80; Granfield, Farrar & Carlin, San Francisco, $19,754.70; C. R. Butterfield, San Pedro, $17,777.40; R. E. Campbell, Los Angeles, $21,467.60; L. A. Brisco, Arroyo Grande, $21,257.80; Dimmitt and Taylor, Los Angeles, $14,020.20; A. S. Vinnell Co., Los Angeles, $16,175.40; C. G. Willis & Sons and Chas. G. Willis, Los Angeles, $13,939.70; Western Motor Transfer, Inc., Santa Barbara, $14,736.68; Oneal & Smith, North Long Beach, $15,627.20; Robert D. Paterson, Santa Barbara, $19,805.90. Contract awarded to C. O. Sparks & Mundo Engineering Co., Los Angeles, $12,137.70.

SANTA BARBARA COUNTY—Between 1 mile north of Rincon Creek and Carpinteria, 1.5 mile to be graded and paved with asphalt concrete or natural asphalt. District V, Route 2, Section H. Oswald Bros., Los Angeles, $130,411; Southwest Paving Co., Inc., Roscoe, $131,817. Contract awarded to Healey-Moore Co., Oakland, $123,321.

SANTA CRUZ COUNTY—At Inspiration Point between Los Gatos and Santa Cruz, 0.1 mile to be graded. District IV, Route 5, Section B. Oneal & Smith, Long Beach, $36,325; Earl W. Heple, San Jose, $37,885; Peninsula Paving Co., San Francisco, $39,135. Contract awarded to J. L. Conner, Monterey, $33,425.

SANTA CRUZ COUNTY—Concrete girder bridge across Corralitos Creek, about one mile E. of Watsonville. District IV, Route 32, Section A. F. O. Bohnett Co., Campbell, $15,925; Lorance C. Karstedt, Watsonville, $14,394. Contract awarded to A. Soda & Son, $12,962.

SOLANO COUNTY—1 mile west to 0.7 mile east of Vacaville, 2.5 miles to be graded and paved with P. C. C. District X, Route 7, Section C. A. Teichert & Son, Inc., Sacramento, $130,071; Union Paving Co., San Francisco, $123,676; N. M. Ball Sons & Larsen Bros., Berkeley, $134,379; Wood & Bevanda, Stockton, $144,266; D. McDonald, Sacramento, $134,763; Hanrahan Company, San Francisco, $146,354. Contract awarded to Fredericksen & Westbrook, Lower Lake, $114,341.

STANISLAUS COUNTY — At Bassos Ferry, 2 miles west of La Grange, Tuolumne River Bridge to be repaired. District X, Route 110, Section E. Martin Murphy, Albany, $19,840; M. B. McGowan, Inc., San Francisco, $15,515; Garbarini & Orselli, Oakland, $17,885. Contract awarded to F. O. Bohnett Co., Campbell, $14,530.

YOLO COUNTY—Between Woodland and Knights Landing, about 11.4 miles of nonskid surface treatment and natural rock asphalt to be applied to portions of pavement. District III, Route 87, Section A. Independent Const. Co., Ltd., Oakland, $12,-367; W. H. Larson, Oakland, $12,844; A. Teichert & Son, Inc., Sacramento, $11,-776; Hanrahan Co., San Francisco, $12,390. Contract awarded to E. A. Forde, San Anselmo, $11,579.

HIGHWAY ENGINEERING RESEARCH REVIEWED

(Continued from page 19)

The use of heated sand has been reported to give satisfactory results on some highways in Canada. This operation is carried on by having supply stations at convenient locations.

The research developments discussed, are few of the many under way. The yearly publication of research results indicates how practically all highway problems are being studied and remedies proposed.

A man wrapped up in himself makes a very small package.

Day Labor Plan Assailed at Road Builders' Session

COMPARATIVE opportunities of the working man under the day-labor system and under the contract system, and the resulting effects that the day-labor system has upon him, were discussed by Frederick Hoitt, at the highway contractors' sessions of the 34th annual convention of the American Road Builders' Association, in New Orleans, January 11-15. He also touched upon the present day trends toward organization of the highway industry.

Mr. Hoitt is secretary of the New England Road Builders' Association, an organization affiliated with the American Road Builders' Association.

"There is hardly a contractor who has not, over the years, taken men from ordinary routine positions and advanced them step by step to positions of greater responsibility until they reached top places in the organization, and ultimately graduated into business for themselves," declared Mr. Hoitt.

ATTACKS DAY LABOR PLAN

"Other men have been trained regularly and advanced by contractors from employments of an unskilled nature to places as skilled machine operators, with the accompanying rewards of increased wages," he continued. These opportunities for advancement do not exist under the day-labor system, he pointed out.

The day-labor method and the accompanying practices under that method breed inefficiency, wastefulness, indifference and irresponsibility, according to Mr. Hoitt. The effect upon the moral fibre of working men is unwholesome and definitely destructive, he believes. "That, we think, is a much more serious indictment of the day-labor system than is the fact that it deprives contractors of work that is properly within the scope of their business activities," he declared. "It is wiser and sounder—and certainly best for the interests of the taxpayers—to do public works construction in the most efficient and economical manner, free from abortive unemployment relief devices.

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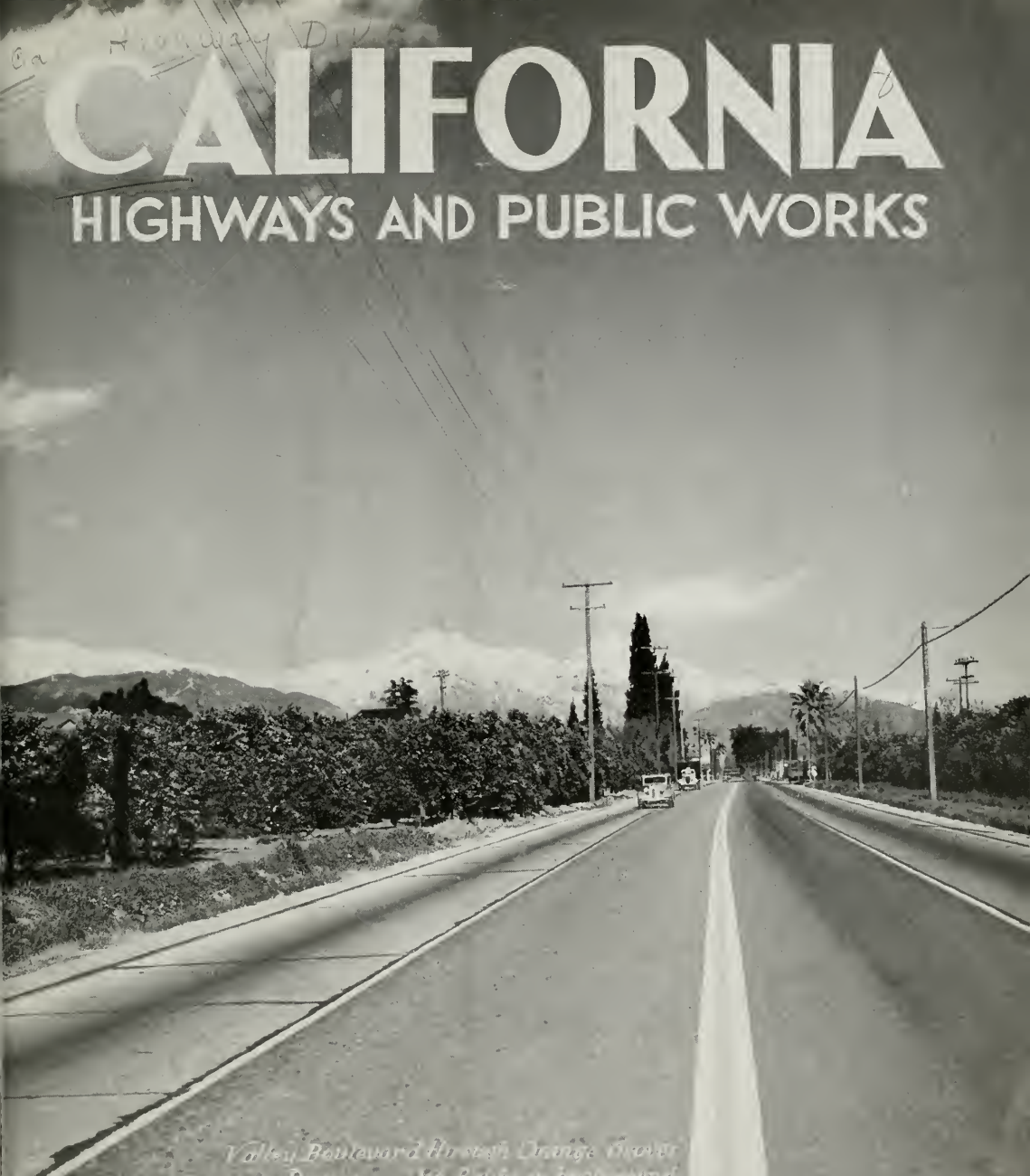


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HIGHWAYS AND PUBLIC WORKS



Valley Boulevard through Orange Grove near Pomona. Mt. Baldy in background

Official Journal of the Department of Public Works

FEBRUARY 1937

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CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways of the Department of Public Works, State of California

EARL LEE KELLY, Director | C. H. PURCELL, State Highway Engineer | JOHN W. HOWE, Editor

Published for information of the members of the department and the citizens of California

Editors of newspapers and others are privileged to use matter contained herein. Cuts will be gladly loaned upon request.

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2,350 Miles of Highway Improved; 82 Bridges, Grade Separations Built in 1936

By GEORGE T. McCOY, Assistant State Highway Engineer

DURING the calendar year of 1936 construction and maintenance activities of the California Division of Highways reached a total of $40,190,200. Of this amount $29,929,900 is the cost of construction work put under way during the year and financed from State and Federal funds.

Of this total for construction $18,363,900 represents the amount which was allotted from money derived from State revenues and $11,566,000 is the amount on which Federal reimbursement will be made.

These figures show that the construction program placed under way during 1936 was made largely possible by Federal contributions from funds provided by Congress for the Works Progress Administration and regular Federal aid for State highway construction authorized for the fiscal years ending June 30, 1936 and 1937, under the Hayden-Cartwright Act.

Approximately 39 per cent of the entire construction program was financed by these Federal funds.

ORIGIN OF FUNDS

Segregation of the amounts and percentages making up the total for contracts to the various funds is shown in the following tabulation:

Funds	Amount
Regular Federal Aid (1936 and 1937)	$6,788,000
Emergency Relief Appropriation— (WPA)	4,778,000
State Highway	18,363,900
Total	$29,929,900

In the foregoing tabulations the State highway funds include expenditures from revenues to the Division of Highways from the gasoline tax and motor vehicle fees for construction, minor improvements, betterments, and contracts financed from one-fourth cent funds allocated to cities.

The total amount of construction and maintenance put under way between January 1 and December 31, 1936, and represented by the $40,190,200, may be segregated to the various classifications of work as follows:

Construction	$29,929,900
Minor Improvements	1,136,600
Betterments	1,804,000
Maintenance	7,319,700
Total	$40,190,200

2350 MILES IMPROVEMENT

Progress of construction activities on the State highway system as gauged by the $29,929,900 of construction undertaken during the year for a total of 2350 miles of highway graded, surfaced, or oiled and 82 bridges and grade separations constructed is shown by the following tabulation giving types of improvement, mileage for each type and amount of money required for the work.

Type	Miles	Amount
Pavement	214	$7,709,600
Bituminous treated crushed rock surface	357	8,294,900
Untreated crushed rock surface	83	1,236,100
Graded roadbed	170	4,434,400
Oiled roadbed and shoulders and seal coat	1526	1,720,300
Bridges and grade separations	(82)	3,325,100
Miscellaneous construction		3,209,500
Totals	2350	$29,929,900

On January 1, 1937, the Division of Highways entered the last quarter of the current biennium with only about fifteen budgeted projects, amounting to some $2,700,000, remaining to be placed under way before the beginning of the new biennium on July 1st. This favorable condition places the Division of Highways in position to begin work in preparing the plans and specifications on major projects, estimated to cost $27,576,900, included in the proposed budget for the 89th and 90th fiscal years as soon as the State Legislature adopts the budget.

This amount of $27,576,900 for major project construction will be made possible by $9,500,000 in regular Federal aid apportioned to California for the biennium and $18,076,900 in funds from State revenue. These Federal funds were appropriated by Congress under the act of June 16, 1936, which amended the Federal Aid Highway Act.

FEEDER ROAD FUNDS

In addition to these funds California is to receive under authority of this act approximately $1,900,000 for secondary feeder roads and $3,744,000 for elimination of hazards at railroad grade crossings. However, until Federal rules and regulations governing expenditure of the $5,644,000 have been received the amount can not be included in the budget.

Construction placed under way during 1936 included, as some of the

(Continued on page 9)

Four Grade Crossing Projects Completed in Los Angeles

By DON WARREN, Senior Bridge Engineer

FOUR grade separation projects recently completely in Los Angeles are at Mission Road, Soto Street and Valley Boulevard, Soto Street between Pico Street and Washington Boulevard, and at Firestone Boulevard.

These projects have all been financed from funds set aside by the Federal Government to be used on grade separation projects. On these projects the State acted as an agent for the Federal Government, contracting and supervising the construction.

The projects were intended to relieve labor and carried the condition that, as far as practical, labor was to come from the relief rolls and that labor be confined to one hundred thirty hours per month. It also stipulated that railroad work could be done by the railroad forces.

CARRIES FOUR R. R. TRACKS

The largest of these projects is the Mission Road Grade Separation, which carries four lanes of Pacific Electric tracks over the junction of Mission Road with Huntington Drive North, Huntington Drive South and Soto Street. This project was built at a cost of $434,000. At this point the traffic count of 1932 showed 43,000 vehicles, and the railroad record of 1935 gives 560 Pacific Electric trains daily.

This structure is built on the location of the old trail which was followed by the padres from the Mission San Gabriel to the settlement of Los Angeles. The evolution in vehicular traffic from the ox-cart days was evidenced by the old bridge structures and culverts uncovered during the construction of the foundations.

The project is 2600 feet long, which includes the railroad approach fills. The main structure, which is 490 feet long, contains 5800 cubic yards of concrete and 875,000 pounds of structural steel. The approach fills provide for a maximum of 1.70 per cent railroad grade.

TRAFFIC WAS CONTINUOUS

The project was planned so that stage construction provided for continuous flow of railroad traffic. The first construction was the placing of retaining walls to confine the railroad fill north of the crossing and also south of it along Soto Street. Then while cast-in-place piles were being driven for the east side of the structure through soft fill material, the railroad forces deposited and compacted the east half of the railroad approach fill.

At the completion of these approaches the supporting members of the main structure were in place and the railroad cranes, moving over the newly constructed approach fill, placed the structural steel girders and beams which span the highway.

EAST HALF BUILT FIRST

During this stage of construction the Pacific Electric trains were confined to the two westerly tracks. On completion of the easterly half of the structure the trains were routed over the structure, the westerly tracks removed, and the westerly half of the project constructed in a manner similar to that of the easterly one.

As an aid to the motoring public the main piers are illuminated with sodium vapor lights, and traffic stripes are provided to confine the flow of traffic to the four roadways under the structure.

ROUTE TO RACE TRACK

It is over this feeder road that a large percentage of the race track enthusiasts find their way to the Santa Anita Race Track, and it is through this structure that the throngs will pass on New Years Day to attend the Pasadena Tournament of Roses and football game.

Another grade separation is at Soto Street and Valley Boulevard where the through traffic along Soto Street is carried over both the main line track of the Southern Pacific Railroad and Valley Boulevard. This overhead structure eliminated a sag in grade as well as the hazards inherent in a blind street intersection combined with a grade crossing of a main line track.

This project is 2200 feet long, and has gentle approaches. To prevent the flow of traffic from Valley Boulevard over the Southern Pacific tracks, Soto Street was deadended at this point. However, provision has been made for the flow of traffic north from Valley Boulevard to Soto Street.

TRAFFIC ISLAND CONSTRUCTED

To minimize traffic friction on this approach, a well lighted traffic island has been placed at the junction of this approach with Soto Street.

This Feeder Road project was completed October 31, 1936, at a total cost of $235,000.

This structure, paralleling the Pacific Electric Railroad Separation over Valley Boulevard, fits pleasingly into the natural surroundings. The roadway, which is protected with an ornate metal handrailing, is supported on steel girders and the graceful substructure makes this overhead one of the most pleasing and outstanding grade separation structures in Los Angeles.

Another grade separation on Soto Street is between Pico Street and Washington Boulevard where the heavy vehicular traffic along Soto Street has been carried under two structures which support the Omaha to Los Angeles main line and the Pasadena tracks of the Union Pacific Railroad.

AUTO TRAFFIC DETOURED

This subway provides for a clear width of fifty-six feet of roadway with five foot sidewalks along either side. The sides of the subway cut are paved with concrete.

During construction the vehicular traffic was detoured around the project

(Continued on page 12)



Four grade separations in the Los Angeles Metropolitan area are shown in this group. At top, left, 2600 foot structure across intersection of Mission Road, Huntington Drive and Soto Street where traffic count showed daily movement of 43,000 vehicles and 560 trains. Inset shows old grade crossing. At top, right, structure carrying 600 interurban trains over Firestone Boulevard that shows a daily movement of 20,000 autos. Inset is view of old grade crossing. At bottom, left, structure carrying Santa Fe railroad tracks over four-lane, divided roadway of Atlantic Boulevard. At right, a 2200 foot structure at intersection of Valley Boulevard where through vehicular traffic on Soto Street is carried over both the main line Southern Pacific tracks and Valley Boulevard traffic.

Vacaville By-Pass on U. S. 40 Under Construction

By R. E. PIERCE, District Engineer

THE Vacaville By-Pass, another unit in the plan for shortening and improving State Highway (U. S. 40) between San Francisco, the bay area and Sacramento, is now approaching completion.

This unit, approximately 2½ miles in length, starts at the easterly end of the recently completed Orchard Line Change, southwest of Vacaville, and keeping south of the built up section of the town runs by very direct alignment to the present road about one-half mile east of Vacaville.

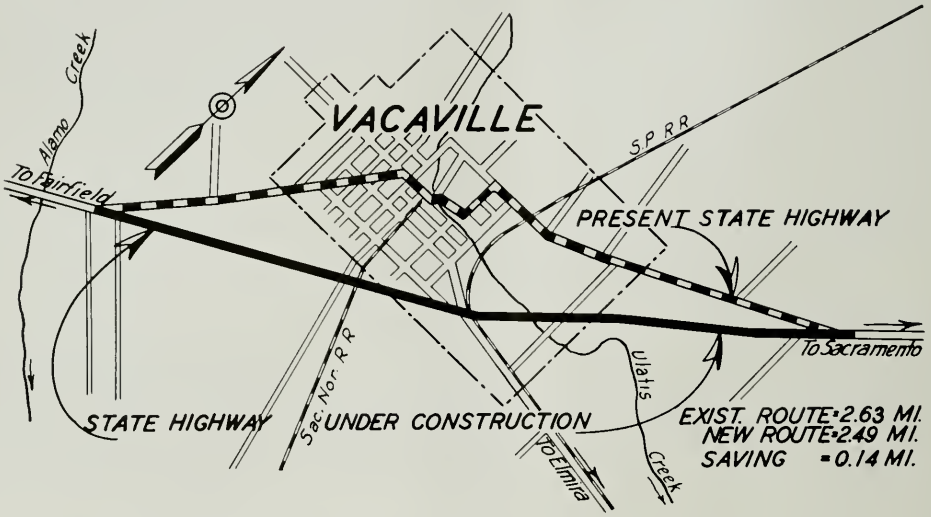
sists in general of constructing a graded roadbed 36 feet wide, placing a layer of selected material over the graded roadbed which has previously been treated by a bituminous roadbed seal and placing a Portland cement class "B" concrete pavement twenty feet wide and 0.55 foot thick, increasing to 0.75 foot at the outside edge from a point two feet inside each edge.

The pavement is to be laid in ten foot strips, which are tied together by tie bolt assemblies.

of the Bay Bridge. The much lighter concrete, it being about two-thirds the weight of ordinary concrete, made these piles much easier to handle and also took only two-thirds as long to drive, as compared with the other piles.

Also in spite of less crushing strength, as shown by laboratory tests, there was absolutely no sign of failure in either of the test piles, while considerable spalling took place in some of the regular piles.

This By-Pass is the fifth project of



This improvement eliminates entirely the narrow, crooked, congested streets of Vacaville, and will be a great help in expediting through traffic, as well as giving the local people a freer use of their streets with greater safety. Both the high school and grammar school are on the existing route through the town and the removal of the through traffic will remove the hazard to children who are forced to cross this street.

The contract now under way con-

A reinforced concrete bridge, with concrete pile bents, has been constructed over Ulatis Creek. This bridge has one 23-foot span at each end and a 30-foot span in the center, and is of the reinforced continuous slab type.

It has a 34-foot roadway with three-foot sidewalks on either side.

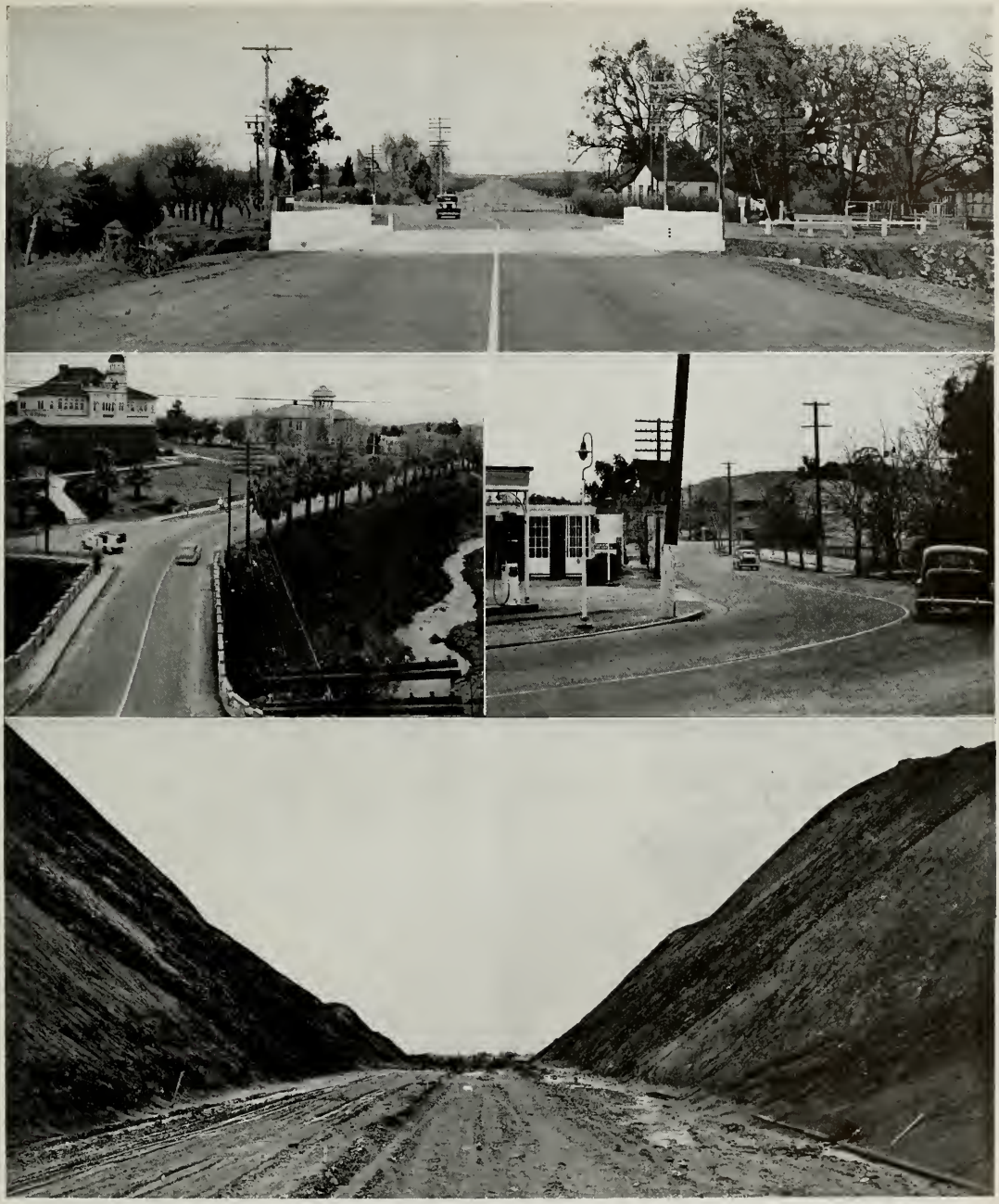
Two piles were constructed using a special light weight aggregate. This is a burned clay, the same material used in the paving of the upper deck

importance in the series on this important road which has been completed to date.

The following are listed in order of completion, showing saving in distance:

Cordelia Cut-off	0.4	miles
Cordelia-Fairfield Cut-off	0.75	miles
Orchard Line Change	0.75	miles
American Canyon Cut-off	6.00	miles
Vacaville By-Pass	0.14	miles
	8.24	miles

(Continued on page 12)



Scenes on the Vacaville realignment project, an improvement to a unit of State highway (U. S. 40) between Sacramento and San Francisco, by-passing the narrow and crooked streets of a congested section of the city of Vacaville. At top, new bridge and end of completed pavement where existing highway enters city on a curve. New alignment, rough graded, extends in direct line to connection with highway one-half mile east of city. Center, left, narrow bridge and street passing two schoolhouses, and at right, short radius "S" curves, schoolhouse in background. At bottom, a large cut on the new alignment.

Olympic Boulevard Developing as Major Los Angeles Arterial

By S. V. CORTELYOU, District Engineer

A CRITICAL traffic situation faces the motor vehicle operators in the metropolitan area of which the city of Los Angeles is the center. According to the 1930 United States Census, the population of Los Angeles City was 1,240,575, and of Los Angeles County 1,891,964; the latter figure being one-third the total population of the State. Of the 2,132,350 motor vehicles (automobiles and trucks only) registered in the State for 1935, Los Angeles County had 867,866, or 40.7 per cent of the total vehicle registration in the State.

Naturally, with the large number of motor vehicles in Los Angeles County at present, which number is increasing steadily, the problem of providing relatively safe, convenient and unobstructed ways for the flow of this traffic is constantly becoming more difficult and more expensive to solve. Probably the greatest mileage of vehicular traffic develops in traveling to and from the down-town business area for those persons who work in the city and those persons who come in to transact business or enjoy the various theaters and other amusements.

TRAFFIC LOAD INCREASING

The population and the motor vehicle registration are increasing at a more rapid rate than the facilities that the city, county and State have been able to plan and construct to take care of this increasing traffic load. It is, therefore, essential that the general public become conscious of this situation so that they will authorize their public authorities (city, county, State and Federal) to plan for the more important major traffic arteries to help carry this load.

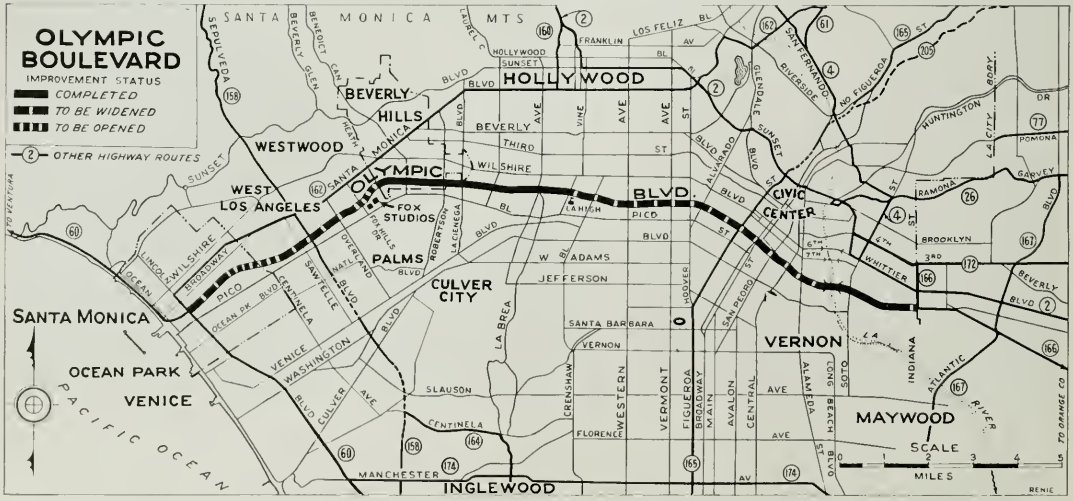
The development by Los Angeles City and the State Division of Highways of the Ramona Boulevard-Garvey Avenue route leading from Los Angeles easterly is a step in the right direction and is intensively used.

Another artery which takes advantage of natural topographic conditions will be the Arroyo Seco Parkway, State Highway Route 205, with its connection to Figueroa Street, Route 165. The latter street has been developed particularly from Sunset Boulevard northerly by Los Angeles City, with a viaduct over the Los Angeles River and the Union Pacific tracks now under construction by State contract. Figueroa Street leads from the ocean through the center of Los Angeles to the mountains, and will be one of the major north and south traffic arteries.

OFFICIALLY NAMED OLYMPIC

One of the most important east and west traffic boulevards, if not the most important, will be Olympic Boulevard, State Highway Route 173, running from Route 60 at Santa Monica, as indicated on the accompanying map, easterly on what is now known officially as Olympic Boulevard, to the east city limits of Los Angeles.

This street name was officially given by the city councils of Los Angeles and Santa Monica to State Highway Route 173, which follows streets formerly known as Pennsylvania Avenue



Aerial view showing the route of Olympic Boulevard, the new East-West arterial, from Los Angeles to the sea at Santa Monica.

A—This portion is the proposed line through the Westwood Hills golf course and the property of the Twentieth Century-Fox Film Company, the latter right of way recently donated by the company.

B—Is the Louisiana Avenue link.

C—A mile of recently dedicated, opened and partially completed roadway.

D—The Pennsylvania Avenue link through Santa Monica.



Spence Aerial Photo *Courtesy Los Angeles Times*

in Santa Monica, connecting with the extension of Louisiana Avenue and Tenth Street in Los Angeles, with an angling connection with Ninth Street east of San Pedro Street in Los Angeles, and thence following the old Ninth Street route to the east city limits of Los Angeles at Indiana Street. At this point it joins State Highway Route 166, generally known as the Anaheim-Telegraph Road.

STARTED FIFTEEN YEARS AGO

The development of this traffic artery was started by a group of far-seeing, public-spirited citizens about 15 years ago. This group, now known as the Olympic Boulevard Improvement Association, has taken a very active and helpful attitude in cooperating with public authorities and property owners to forward the acquisition of rights of way and construction of the road.

The Los Angeles City Engineering Department, under City Engineer Lloyd Aldrich, and under his predecessors, has done a large amount of work, not only in studies of the proper routings, but in making detailed plans for acquisition of rights of way and construction of the street. A number of official efforts were made to have rights of way acquired and various portions of the route constructed under assessment district proceedings, the last proceedings having been vigorously protested by the people in the proposed assessment district, and were abandoned by the city council on February 23, 1933.

These proceedings had been carried out to a point where the necessary rights of way for the Tenth Street opening and widening proceedings were carried through court, and an interlocutory judgment was entered in the sum of $12,215,175.90, plus incidental expenses estimated at $175,000, covering the portion of Olympic Boulevard from Lucerne Boulevard to Indiana Street.

MUCH PROPERTY DONATED

It was felt by the people that the assessments for the opening, widening and improvement of this street would be excessive and should not be borne by an assessment district, but should be paid from public funds.

Considerable progress has been made since the abandonment of the old assessment district proceedings, and great credit should be given to the Olympic Boulevard Improvement Association, under the able leadership of Mr. James C. Dolan, its president, and to Dr. J. Dryden Davenport, president of the Louisiana Street Property Owners Association, who has personally secured donations of many important pieces of right of way.

Olympic Boulevard was made a State highway route by the State Legislature in 1933. Since this time the State Division of Highways has been cooperating with the city, working to eliminate the jogs and poor alignment which tend to prevent the use of the route by the public.

By examination of the accompanying map it will be seen that from Heath Avenue, the west city limits of Beverly Hills, to Rimpau Avenue near the Los Angeles High School, the street has been fully developed, being paved full width, approximately 74 feet between curbs.

The right of way has been secured



Completed portion of Olympic Boulevard in Los Angeles showing high class character of real estate development along the new arterial from the city to the sea at Santa Monica.

for the diagonal connection from Lucerne Boulevard to Bronson Avenue, and construction work is now progressing under a contract which has been let by the city of Los Angeles for the improvement from Rimpau Avenue to Bronson Avenue.

Before the award of this contract a very important step was taken by city authorities to guarantee the most efficient use of this boulevard. At the request of the State Division of Highways, and upon recommendation of the city board of public utilities, the city council refused to give a long-time extension to the Los Angeles Railway for the street car line which followed the Olympic Boulevard route generally from Hoover Street westerly to Victoria Avenue.

The street car company applied for a franchise to construct their tracks in the new right of way of the diagonal cutoff from Lucerne to Bronson. If this had been granted by the city authorities, the traffic carrying capacity of the street would have been very materially reduced and the hazard to pedestrians and motorists both would have been greatly increased, inasmuch as all of the street car passengers would have to walk from the curb to the safety zones in the center of the street, crossing lines of automobile traffic. The safety zones themselves and the impaired use of the area occupied by the tracks would decrease the ability of the street to carry automobile traffic.

ASSOCIATION FOUGHT TRACKS

The Olympic Boulevard Association carried on an energetic campaign to guarantee the removal of the street car tracks and the installation of a bus service. A temporary extension of the Los Angeles Railway Company's franchise was made for three years, as this was the period estimated by the city which would be required for the acquisition of rights of way and the construction of the street between Hoover Street and Bronson Avenue. The Los Angeles Railway Company officials have indicated that they are in full accord with the program of installing bus service at or before the end of the three year extension of their franchise.

The city is busily engaged in acquiring the right of way to eliminate the jog from Hoover easterly, and has already opened the street for the first block east of Hoover Street. The city is also appraising property and negotiating for the right of way to eliminate the jog at Figueroa Street.

FILM COMPANY DONATES

A very important development occurred recently when, after a conference between Dr. J. Dryden Davenport, president of the Louisiana Avenue (Tenth Street) Property Owners Association, Mr. James C. Dolan, president of the Olympic Boulevard

(Continued on page 20)



Olympic Boulevard pavement was stopped at Fox Film company property pending acquisition of Right of Way which the company recently donated to the State. Larger sound stage building in background.

Many Large Highway Projects Completed During 1936

(Continued from page 1)

larger projects on heavily traveled routes, the following work:

On the Coast Route between San Francisco and Los Angeles ten major contracts provided for reconstruction, paving and surfacing on 46 miles of highway aggregating $1,786,500 in cost. These contracts included such important improvements as grading and surfacing on the Conejo grade in Los Angeles and Ventura Counties, paving between Bradley and 6 miles south of San Ardo in Monterey County, widening and paving the 10 miles south of San Jose to Coyote and the new wide pavement between San Mateo and Redwood City on the Peninsula.

COAST ROAD IMPROVEMENTS

In San Diego County four contracts amounting to a total of $1,035,500 provided for reconstruction of 15.6 miles of the main highway from Los Angeles to San Diego between Del Mar and Encinitas, Oceanside to the Las Flores underpass, a bridge across the Santa Margarita River and on Main Street in the city of San Diego.

In the San Joaquin Valley on the Los Angeles-Sacramento highway six contracts totaling $829,400 were awarded for reconstruction projects on 45.6 miles of this heavily traveled arterial. Two of these contracts provided for widening and paving from Belmont Circle to Herndon north of Fresno and a third was for paving 11.7 miles south of Bakersfield.

Probably the largest single project undertaken during the year was the construction in Marin County of the Waldo approach to the Golden Gate Bridge. This northerly approach to the world's longest span suspension bridge connects with the Redwood Highway at Waldo Point just north of Sausalito. The work is being performed under two contracts, one for the grading and surfacing of 2.8 miles of highway and the other for the construction of a 1000-foot concrete lined tunnel. The total cost of the project is $1,716,322.

NILES REALIGNMENT PROJECT

Another large project in the Bay area was located on the Oakland-San Jose route at Niles in Alameda County. Work under this contract involved the realignment of the highway, construction of six grade separations with the tracks of Southern Pacific Railroad and Western Pacific Railway and a bridge across Alameda Creek. This improvement is estimated to cost over $600,000.

In Los Angeles County the State has awarded contracts amounting to more than $900,000 for construction and improvement of 8.8 miles of Sepulveda Boulevard, the largest section being that between San Fernando and Brand Boulevard.

Over $300,000 was expended for improving and widening the Foothill Boulevard, chiefly on the 8 miles between Azusa and Claremont. During the year further work on the construction of the Rosemead-Cerritos Avenue project which connects Pasadena with Long Beach, included about 9 miles of pavement and surfacing, one bridge and one grade separation amounting in cost to over $400,000.

TEN JOBS COVER FIFTY MILES

Nearly $1,000,000 in contracts were placed under way on State Highway 26 which connects Los Angeles with El Centro. While no one of the contracts was very large the 10 major ones provided for improvement to nearly 50 miles of highway in Los Angeles, San Bernardino, Riverside and Imperial counties.

In desert sections of California the State highway across Death Valley was improved to the extent of about $225,000 and 21.1 miles graded and surfaced.

Construction on the East Shore Highway in Berkeley has provided some 5.8 miles for the northerly approach to the San Francisco-Oakland Bay Bridge. Three contracts awarded in 1936 for this work amounted to $350,000.

LAST BAYSHORE SECTIONS

About $385,000 provided for the last sections in the construction of the Bay Shore Highway between San Francisco and San Jose and resurfacing of the heavy fill section between Redwood City and San Mateo.

On the Sacramento-Truckee route three contracts were awarded east and west of Donner Summit covering a distance of about 9 miles and costing $434,500. This work provided a much needed improvement of this section of U. S. 40 across the high Sierras where snow plows are kept continually in operation during storms.

Reconstruction of the Walnut Creek-Oakland road has provided a modern highway in Contra Costa County which will connect with the low level Broadway tunnel now under construction in the Berkeley Hills. Two contracts for grading and surfacing this road from the easterly tunnel entrance to Walnut Creek amounted to $675,000.

Under the conditions governing the expenditure of Works Progress funds stipulation was made that a certain percentage of the Federal funds should be expended for improvement to Federal roads not on the State Highway System. During 1936 the Division of Highways awarded nine contracts for such work amounting to $1,516,180 and providing for construction of 45.4 miles of county roads and 3 grade separations. The work was well distributed over the State, involving construction in San Diego, San Bernardino, Imperial, Los Angeles, Santa Clara, Alameda, Sacramento and Mendocino counties.

1,617 Miles of Gotham Roads Need Widening

New York State, possessing the most people, the most motor vehicles and the busiest roads, faces a road construction problem perhaps unequaled by any State.

A large task is confronted in highway widening alone, reports E. C. Lawton, assistant commissioner of construction, division of highways.

"By 1940, 1,617 miles of the State system should be widened to three lanes and 929 miles to four lanes," says Mr. Lawton. "When it is considered that there are only 770 miles of three-lane pavement and 229 miles of four-lane pavement in the State, the magnitude of the problem which confronts the Department of Public Works can be realized."

Beggar—Excuse me, sir; you gave me a counterfeit bill.

Gentleman—Keep it for your honesty.

Construction History of San Francisco Bay Bridge

By CHARLES E. ANDREW, Bridge Engineer

(Excerpts from Address at Convention of American Association of State Highway Officials)

DURING the past four years San Francisco has enjoyed the unique position of having within its borders the construction of the world's two largest bridges. These two great projects have had a very profound influence during the recent depression, not only locally, but nationally. As a matter of fact, San Francisco and the bay district have, on account of these projects, felt the depression less than any other part of the nation.

To date eighty millions of dollars have been spent, fifty-two millions of which have been expended on the San Francisco-Oakland Bay Bridge and twenty-eight millions on the Golden Gate Bridge. Approximately 10,000,000 man-hours of labor have been used locally and nearly an equal amount elsewhere in cement mills, steel mills, fabricating shops, etc., on the construction of the Bay Bridge.

Inasmuch as this is probably the first so-called major bridge and certainly the largest bridge that has been wholly designed and constructed by any State highway department, the general plan of organization will be of interest to you as State highway officials.

BRIDGE AUTHORITY CREATED

The laws governing and authorizing the San Francisco-Oakland Bay Bridge are primarily somewhat general, as they permit the construction of self-liquidating bridges anywhere in the State.

They create a body known as the Toll Bridge Authority, consisting of the Governor, Lieutenant Governor, Director of Public Works, Director of Finance and chairman of the Highway Commission. The Toll Bridge Authority is a fiscal body, directing where bridges shall be built under the act, issuing and selling bonds secured only by tolls, fixing rates of tolls, and finally redeeming bonds. The Chief Engineer of the Toll Bridge Authority is the State Highway Engineer.

Under the law the designing, constructing, maintaining and operating are responsibilities of the Department of Public Works, of which the Highway Division is a part. After completion, the bridge becomes a part of



C. E. ANDREW

the highway system. The San Francisco-Oakland Bay Bridge is a project under this general law. Should it be found advisable or for the public good, other bridges, if self-liquidating, can be built in a similar manner and setup.

As organization history, all of the original studies of foundation conditions, bridge location, design studies, estimates and financial considerations were made and assembled by the State Bridge Department in Sacramento during the latter part of 1928, 1929 and 1930, and constituted the body of the Hoover-Young Report, through which the permit from the Army Engineers was granted to build the structure. Estimates of cost of seventy-seven millions for the completed bridge made in 1929 are within a very small percentage of the actual final cost.

Late in 1931, a design office was established in San Francisco to make detailed design plans. The general organization then established was a chief engineer who was also the State Highway Engineer, a bridge engineer in general charge of design and construction, a design engineer in direct charge of design, and four resident engineers in direct charge of construction; also, an engineer in charge of triangulation and surveys and a right of way department.

Detail design plans for foundations were completed late in 1932 and bids received in March, 1933. Work was under way by June 1, 1933. Since that time contracts have been let and completed in scheduled sequence with such precision that practically no time has been lost because one contractor lagged behind the others.

FEDERAL COOPERATION

I consider that this project has enjoyed the finest possible cooperation with the Federal government and all its agencies. Our problems might easily have become difficult and involved, but we have always found that frank discussion and honesty of purpose will always receive fair consideration and just conclusions from all the Federal agencies with which we were required to deal.

Our financial problems were, of course, intricate, involving as they did

intensive traffic and income studies and requiring long and more or less tedious reports. Here again our relations with the Reconstruction Finance Corporation were most pleasant. We have found that they "must be shown," but when shown they are eminently fair and excellent business men. We have always given them our financial problems in an open, frank, and complete manner and have received the finest possible treatment in return. They have shown implicit faith in our designs, construction, and expenditure of funds. They have offered no interference and have been extremely prompt in decisions.

Likewise our relations with the Bureau of Public Roads have been most pleasant and in fullest cooperation. They, too, have shown faith in our designs and construction and we have not broken faith with them.

New Bridge Precedent

It is probably presumptuous to say that there is anything really new in engineering in these days of great engineering projects such as dams, bridges, power plants, etc.

I do, however, feel safe in saying that even though there is nothing new, at least we have gone beyond precedent in many phases of bridge building which may have been done on a smaller scale heretofore. These unprecedented things not only apply to engineering, but also to contractor's operations. I could not here recount all the exceptional phases of this project, neither can I go into great detail.

There are, however, several outstanding features which I shall mention later in some detail with pictures and if questions are asked in further detail I shall be glad to attempt to answer them.

Romance in Foundations

The romance of bridge building is, I believe, quite considerably confined to foundations. Superstructures, of course, require great skill and study, but for the most part are capable of, and confined to, mathematical computation and strength of materials. Generally speaking, they are finite in character.

On the other hand, each foundation is a problem in itself. Each foot of the way to rock or other suitable material may develop some new problem or situation which can not be predetermined.

In the locating and designing of the piers for this structure some $250,000 were spent in prospecting foundation material. Not only was the foundation material carefully studied, but great care was taken in determining the character of material through which the caissons were sunk to reach final foundation. Data so obtained were invaluable both to the designer and the contractor. The great care taken in these foundation surveys resulted in almost an exact check in final construction and we may without doubt attribute our success very largely to this advance information.

Piers in Deep Water

Piers have been sunk in two cases to over 240 feet below water, and in several other cases well over 180 feet on this project. In the East Bay, rock was at such great depth that it could not be reached and we were forced to rely on sandy clay for foundations. Intensive study was made of these materials and the result has been that no settlement has been observed worthy of note.

Much has been written of the details of the Bay Bridge foundations, and no doubt most of you are familiar with them, so I will not attempt to enter such a large subject here. Suffice it to say that I believe the methods used and the results obtained here will stand as an outstanding achievement, and lend encouragement to engineers and contractors in attempting greater depths if the future demands.

Another World's Greatest

Among the list of world's greatest things accomplished on the Bay Bridge is the Yerba Buena Island tunnel. Yerba Buena Island is geologically made up of very badly shattered shale and sandstone. The tunnel excavation required a bore approximately 80 feet wide by 60 feet high. The method of excavating constituted primarily two side wall headings and a crown heading. Rock was then stoped out in alternate sections of about 20 feet from the side headings to the crown headings. Temporary roof support was effected by 16-inch steel H-beams, 3-feet centers, bent to the arch of the roof. Placing of concrete lining followed very closely this excavation. In all cases the concrete lining was placed tight against the rockface. No backfilling was used except pressure grout. For the first time the concrete in the lining was placed by means of concrete pumps and vibrated into place with mechanical vibrators. We believe this method far superior to the former use of cement guns.

After the lining was complete, the upper deck road was placed and the upper tunnel section lined with tile.

No Cave-ins Occurred

In spite of the extremely broken and faulted character of the rock and due to the constant vigilance of both engineers and contractors, no cave-ins of any consequence occurred.

For the first time in major bridge design and construction the twin suspension type of superstructure with central live load anchorage has been used.

The long backstay in San Francisco injected some considerable question of deflection when combined with the long side spans necessary. Connection of the cables to the central anchorage in order to transfer unbalanced live load to the structure was new in bridge design.

In the East Bay we have the longest cantilever span in the United States, a 1400-foot span. Due to its great clearance height, rough uncertain water, and great weight, the suspended span could not be lifted, but was cantilevered out 700 feet from each tower.

In order to tie the structure together as much as possible longitudinally against earthquake influence, portions of the bridge up to 5,000 feet in length were constructed without expansion joints. This fact has required expansion joint design twice as long as ever before. In high-speed electric rail tracks this becomes a major problem.

As to contractor's problems, many are novel and outstanding.

First, the foundation contractor's problems, which are extensively covered in former publications. Suffice it to say that the outstanding success which they enjoyed was due to new and excellent equipment, high-class supervision and personnel, and last but not least, a very close cooperation with and attention to engineers. All of them made satisfactory profits and would like to do the job over again.

In superstructure erection several new methods and devices were developed, among them the use of hammerhead cranes to erect the suspension towers, which proved to be a rapid and efficient method.

A new type of catwalk was used, the novelty being the use of wire mesh instead of plank for the walkways. A great reduction in wind resistance was effected as well as an efficient and rapid erection with less weight.

Double Spinning-Wheel

Cable spinning was largely conventional except the use of a double spinning wheel was perfected which greatly increased performance.

The erection of stiffening trusses was also new. Instead of the conventional method of erecting member by member, two panel sections were erected in a yard on railroad ways, loaded on barges, and towed to the bridge where they were hoisted into place by hoisting girders supported by the cables. The motive power consisted of hoists on the adjacent piers. Lifts up to 205 tons were made in this manner direct from barges in the bay below. As many as four sections were erected in a day.

All steel was shipped unpainted and sandblasted in the yards before shipment to the site, the first red-lead coat being applied. After erection three additional coats were given.

Remarkable Painting Record

One of the most remarkable records made on the job is that of the painting contractor. His progress was such that within four weeks after the floor paving was finished, all surface, except a small amount of sidewalk and part of the lower floor system, was finished.

Over 125 painters were employed. The painting contractor's performance will stand as a record for a long time. It is of interest to note that the complete painting job on the San Francisco-Oakland Bay Bridge involves an expenditure of nearly $1,700,000. Worthy of further note are some of the treatments and methods applied to concrete forming and placement. In no other bridge has the use of mechanical vibration of concrete been so exclusively used. Practically all of the 1,000,000 cubic yards have been mechanically vibrated. By the use of vibration we were able to reduce the water cement ratio to a minimum and at the same time obtain a sufficiently dense concrete with high strength and a minimum shortage. In this connection we have had no trouble in obtaining 4000-pound concrete consistently with five and five and one-half sacks of cement per cubic yard. Extensive use has been made of plywood panels for form work and by its use in connection with mechanical vibration concrete finishing was reduced to a minimum.

The placing of concrete floors on the structure was in itself a major contract and constituted the equivalent of approximately 18 miles of 20-foot pavement. The lower deck is 6½ inches thick and 31 feet in width.

(Continued on page 20)

Four Grade Crossing Projects Completed in Los Angeles

(Continued from page 2)

and the railroad traffic was provided for by stage construction.

The heavier girders for the railroad tracks weigh eighty-four tons each and rest on concrete abutments.

This feeder road project was opened for traffic on December 21, 1936, at a total cost of $235,000.

The Firestone Boulevard Grade Separation provides for the carrying of the four high speed interurban tracks of the Pacific Electric Company over Firestone Boulevard.

Long gradual approaches carry these tracks to a steel structure which spans Firestone Boulevard.

Firestone Boulevard, a main trunk highway carrying traffic to the south, was estimated to carry 20,000 automobiles daily, and at this point the interruptions from train crossings were 600 daily.

During the construction of this project the Pacific Electric trains were confined to two "shoofly" tracks placed west of the structure. The construction required that retaining walls be built along Graham Avenue and Park Avenue, followed by the placing of the railroad approach fills and the pouring of the substructure for the spans across the boulevard.

The approach fill of 106,000 cubic yards was made by rail shipments from Long Beach. On completion of these fills the railroad cranes, working from the abutments, placed the structural steel girders and beams across the highway.

To provide for pedestrians a subway was constructed through the railroad fill and under the tracks at Eighty-fourth Street.

Three railroad stations, one at Eighty-fourth Street, one at Firestone Boulevard and one at Kent Station, were constructed for the convenience of local residents.

With the exception of a few hours when structural steel was being erected, traffic was permitted to pass through the project.

At a total cost of $323,000 the project, including railroad work, was completed on February 6, 1937.

In addition to these four structures other grade separations have been built in the metropolitan area of Los Angeles. These projects have been built entirely by funds authorized in the Grade Separation Program and were constructed under the direction of the Division of Highways.

These grade separations, which are located at some of the most dangerous crossings in the southland, are a great boon to the traveling public for they permanently eliminate hazard and interference and permit safe, free and uninterrupted flow of a great volume of highway and railroad traffic.

Driver Crossed the Double Line: 1 Killed; 9 Hurt

(Editorial from Stockton Record)

Central California today has the grim lesson of what may happen when a motorist flouts the law governing the highway double line. In a crash at Paradise Cut involving three cars one man was killed and nine other persons were injured, several of them seriously. Had it not been for the cool head and skill of a bus driver, a motor stage would have been added to the pile-up of vehicles. From the evidence at hand, it all occurred because the man who was killed crossed the double line.

This type of highway marking is there for a definite purpose. In some places where the double line appears, the motorist can not always figure why it was put there. If he thinks no officer is in sight, he will take a chance by disregarding it. Sometimes he will get away with his infraction. But he is inviting tragedy by crossing the line.

The double lines were put on roads and highways under the direction of officials who know more about traffic hazards and danger spots than the average motorist. They were marked there to prevent such smash-ups as occurred last evening. When driving, see that YOU do not cross the double line!

Advertising of Highways Held to be Good Business

IF MODERN highways are worth building they are worth advertising, in the opinion of Mississippi State highway authorities.

Advertising of attractive roads increases traffic on them with a consequent increase in purchases of gasoline and a corresponding rise in gasoline tax revenues. At least, that is the way Mississippi figures and it has appropriated $100,000 to publicize its highway building program.

One Mississippi newspaper editorializes on the matter as follows:

Here's a business point of view. Mississippi is spending 42 millions on highways and $100,000 on advertising. The more people who travel our highways the more gasoline will be bought and the more gasoline is sold the more taxes the State will collect to apply on the cost of these highways. It seems logical that $100,000 be spent to encourage people to ride our 42 million dollars worth of highways.

VACAVILLE BY-PASS ON U. S. 40 UNDER CONSTRUCTION

(Continued from page 4)

Other possible changes will reduce the distance by another six miles, which if built, will make a total saving of 14 miles between Sacramento and the Bay Area.

This job is being done under contract by the firm of Fredricksen and Westbrook; the contract price is $114,341. Considerable delay has been experienced due to rainy weather, but as soon as the subgrade dries out, rapid progress can be made.

Geo. Hubbard is the resident engineer for the State on the job.

GASOLINE TAX SHOWS INCREASE

California motorists used more gasoline in 1936 than ever before in the history of the State.

Increased use of motor vehicle transportation brought the revenue from December sales up to $4,093,574.53, an increase of 20.02 per cent for the month to bring the annual total income from the 3-cent tax to a new record of $48,286,080.92, it was announced by the State Board of Equalization which assesses the tax.

Significance of "Slow" Group of California Highway Signs

By F. M. CARTER, Assistant Maintenance Engineer

THIS, the second in a series of articles dealing with highway signs used by the Division of Highways to safeguard and expedite traffic on California State highways has to do with the "Slow" group of the warning type of signs.

This group of signs, all yellow in color with black letters or symbols, is designed only to indicate some physical condition of the highway or an operating hazard. For convenience warning signs are divided into two classes: namely, "Slow" and "Caution" types.

A "Slow" sign is used only where a permanent physical hazard exists, which is a part of the highway itself, always requiring a reduction in speed for safety. All signs of this type are diamond shape. Their message is of such importance that all in this class have this distinctive shape and are equipped with reflector buttons for the guidance of night traffic.

MOST IMPORTANT WARNING

The "Slow" sign is considered the most important in the warning series.

Experiments have been conducted to determine the quickest way to give the message to the motorist. It has been determined that this is best accomplished by using only a symbol, when possible, without unnecessary or distracting wording.

When wording is necessary on this type of sign, the message should be very short—one word is preferable.

The diamond shape is used exclusively for this type of warning and thus the shape aids in transmitting the message that reduced speed is advisable. Whenever a safe driver sees a diamond shaped yellow sign he takes his foot off the gas and slows down.

It is imperative that the diamond shaped "Slow" type signs be carefully positioned, and only after a thorough study of the location.

Learn the Sign Language Taught in These Articles

The proper signing of California highways is regarded as one of the most important functions of the Division of Highways in contributing to safety of life and vehicular traffic. In carrying out this aim the State has adopted the uniform sign system recommended by the American Association of State Highway Officials and adopted by the U. S. Bureau of Public Roads. A detailed description of the signs and the vital messages they bear will be found in a series of articles in these columns, of which this article is the second. Others will appear in later issues.

Uniformity of positioning is important because the wise motorist drives in accordance with the signs of this type. This warning sign is placed 400 feet in advance of the beginning of the curve, and on the right hand side of the road, so as not to be obscured by oncoming cars.

Two signs of different type and carrying a different message are not placed closer together than 100 feet if possible. Where a warning sign and a guide sign are needed at approximately the same location, the warning sign location precedes the guide sign.

On wide up-to-date highways where right of way for future widening is already provided and the entire roadbed graded, some engineers have placed their signs at the extreme limit of the right of way. Signs placed so far from the traveled way not only fail to give the message to the motorist, but, because of the lack of message, or the motorist's attempt to read the signs, more hazard is introduced.

ALL ARE REFLECTORIZED

Because of increasing speeds and the ease of driving, night travel has made it necessary to reflectorize all signs of this type.

In order to obtain the best return reflection, all reflectorized signs are placed as near to the traveled way as is consistent with safety. The standard distance is eight feet from the edge of pavement.

Being reflectorized, these curve signs are positioned not at right angles, but slightly away from the direction of the highway so that the light falling on the background of the sign will not be reflected back to the motorist in a confusing glare. This positioning does not diminish the return reflection of the buttons in the symbol because of the wide angle of return reflection.

There are seven of this group of curve signs:

1. **The right reverse curve.**
2. **The left reverse curve.**
3. **The right sharp angle curve.**
4. **The left sharp angle curve.**
5. **The right 45° angle curve.**
6. **The left 45° angle curve.**
7. **The tee intersection.**

The symbol on the sign indicates the direction of the curve.

CURVE SIGN SIGNIFICANCE

A curve sign is used when safety requires a slackening of speed because of high degree of curvature, obstructed visibility, narrowing of pavement, lack of superelevation, or similar conditions. Such curve signs are positioned only at curves where the speed of approach can not be safely maintained on the curve itself.

The reverse or "S" curve sign (1 and 2) is positioned 400 feet in advance of two curves in the opposite direction with short tangent between them. The direction of the symbol in its first curve designates whether it is right or left.

(Continued on page 18)

California's Uniform Road Sign System Pr

"Slow" Warning Group



This sign indicates a left reverse curve and calls for a slackening in speed, possibly because of high degree of curvature.



For a right reverse curve this sign is used. It may also warn of obstructed visibility or narrowing of pavement.



A sharp left angle curve is indicated by this sign. It is positioned in advance of curves of short radius.



Similarly this sign is used for a sharp right angle turn of 60 degrees or over.



A 45 degree left angle curve calls for this sign. It is for curves of less than 60 degrees.



For a 45 degree right angle turn this one is used, also on curves of less than 60 degrees.



At tee intersections this symbol is used and is one that should never be disregarded.



The "Slow" sign is the most important in the warning series. When a safe driver sees this he takes his foot off the gas. It is not used alone, but followed by an explanatory sign.



Motorists approaching a subway see this sign. It is a warning that should be followed by cautious driving.



This sign warns of a grade ahead and the careful driver is prepared for a different speed and increased caution.

des Drivers An Infallible Guide to Safety

"Slow" Warning Group



This sign is placed in advance to mark the end of a road or blind street.



A dip in a road ahead is indicated by this warning to avoid possibility of a dangerous jolting of the car.



Motorists should slow down when they see this sign. Danger lurks in narrow roads.



Warning of a narrow bridge is important to motorists as increased attention to driving is imperative to avoid accidents.



Slower speed is advisable when this sign appears and caution in entering such a subway is advisable.



A one way bridge is a hazard and this sign should impel motorist to be sure no other car is on bridge before crossing. It is placed where roadway width is less than 16 feet.



This sign is a warning to slow down for a stop sign ahead. It is placed 400 feet in advance of the STOP sign.



The careful driver will pay heed to this warning that soft highway shoulders and sand lie ahead and thus avoid a possible skid and overturned car.



This sign cautions a driver to slow down for a nonpaved road. Necessarily a slower speed is indicated.



Different traffic conditions ahead may be expected when this sign shows up on a three or four lane highway and a cautious driver will not ignore it.

Federal and State Policies On Feeder Roads Discussed

By HARRY A. HOPKINS, Chairman California Highway Commission

IT WAS my pleasure during the twenty-second annual convention of the American Association of State Highway Officials in San Francisco to preside over the sessions of the Administrative Committee of that body.

At our group meetings we discussed many problems connected with highway administration and exchanged interesting and valuable ideas.

Various topics were assigned to authoritative speakers who presented their subjects, after which the committee members engaged in general discussion. It might be well to take up in chronological order the sundry matters considered.

Our new association president, Mr. T. H. Cutler of Kentucky, offered a paper on what States can do to publicize their work. He advised wider use of such agencies as magazines, the press, radio, photographic material, signs, exhibitions and motion pictures with attendant data on accidents and information in general, together with a closer contact with civic and other organizations.

PROTECT GAS TAX FUNDS

The conclusion reached by our group is that no State has reached the maximum amount of effort to publicize highway work that could be used as a model for other States to follow in making our citizens highway conscious. It was the concensus that every state should enlist the aid of the public in protecting gas tax funds from diversion and that to this end states should spend greater sums from the gas tax to carry on such educational propaganda.

On the question of whether states are ready to assume the economic problems involved in starting a program for divided highways, Commissioner M. D. Van Wagoner of Michigan read a very instructive paper, which will appear in a later issue, of California Highways and Public Works in which he raises some interesting questions concerning this innovation.

All those attending the sessions of the committee feel that we are confronted with a condition that will call for greater development of divided highways. The conclusion of the committee was that we should accept as a policy the need for divided highways, but the extent of such development should be subject to consideration by the various states in handling their local problems. It was suggested a further survey be made to determine the attitude of the states with regard to divided highways.

W. W. Zass, Chief Highway Engineer of Arkansas, opened the discussion on "Should Greater Governmental Aid or Assistance be Given in the Construction and Maintenance of Highway Facilities?"

This subject is closely allied with that of the nationalization of federal roads and bridges later discussed by H. E. Tabler of Maryland and the committee's conclusions on the former topic could be applied to either of them.

COMMITTEE CONCLUSIONS

The conclusion reached was that federal assistance should be given to maintenance as well as construction on federal aid roads and while the thought was expressed that there was a danger in nationalization of federal roads and bridges, which would call for greater federal assistance, at the same time it is realized that operation of anything of this kind would cause many legislatures to take advantage of it to the extent that it might have a very apparent effect on the states in the operation of their own highway systems.

It was the concensus of opinion that the parity between construction and maintenance is negligible. Also that the Federal Government should give consideration to nationalization of federal aid roads and bridges, particularly in the public land states, and the participation on federal aid roads now on the basis of approximately fifty-fifty might properly be increased to two-thirds of the cost on the part of the Federal Government.

The question of future federal and state policies in the construction of feeder or local roads was taken up by the general session of the convention and discussion of it in our group meeting was led by T. S. O'Connell of Arizona.

QUESTIONNAIRE CONSIDERED

A questionnaire on this issue was sent to all the states and the sentiment of the committee on the different items involved was substantially as follows:

As to whether or not it would be desirable during the program already authorized to attempt the designation in each state of a system of secondary or feeder roads on which future expenditures for this class of improvement would be confined until the system had been brought to satisfactory completion, the thought prevailed that since the results of the planning survey are not yet definitely known it would be more satisfactory to submit programs of projects covering the expenditure of funds authorized for a two-year period looking to the designation of a system of secondary roads if federal funds continue to be appropriated, the projects selected for construction in this two-year program to be such as will fit into this future system.

It was felt that the states should control the expenditure of funds regardless of how the funds are matched whether by state or other authority.

The thought prevailed that it is desirable to attempt to secure a distribution of the benefits of these secondary road funds to not less than 50 per cent of the counties within a state.

It was conceded by those present that considerable latitude should be given to permit the states to allow the



The Administrative Committee of the American Association of State Highway Officials is pictured in session at the recent annual convention in San Francisco. Chairman Harry A. Hopkins is seen standing at the right addressing the committee.

counties to match funds expended within the county since the state laws, which vary in each of the states, will in the end determine who matches these funds.

It was the thought of the delegates present that the closest cooperation should exist between state highway departments and county authorities relative to the formulating of programs, but it was felt that any such suggestion might well be left to the judgment of the various state highway departments and that no mention should be made of this matter in the regulations.

It was felt that the matter of using county engineering organizations should be left to the discretion of the states to work out.

It was also our belief that those states which cannot legally expend money on roads not included in a definitely established state highway system be permitted to expend the secondary funds on that part of the state system not included in the federal aid system provided that in the opinion of the Bureau of Public Roads a reasonable portion of the total mileage of roads within the state is included in the state highway system.

Mr. A. W. Brandt of New York led the discussion on the proper formula for dividing the cost of railroad crossing eliminations and continuing grade crossing work and the question of to what extent policies should be adopted on types of construction.

The general opinion was that it would not warrant anyone in providing a formula that would be a measure and a guide covering the cost of railroad grade crossing eliminations. Because there was a difference of opinion between the fair proportion of cost allocated to the railroads and the public which differed from a 50-50 basis to as far as the public assuming all of the cost, the conclusion reached was a recommendation that a committee be appointed from the American Association of State Highway Officials to confer with railroad organizations interested in this activity. The position of the Administrative Committee was that it did not possess sufficient research data to arrive at a conclusion.

In the discussion on this very interesting subject, the committee was favored with the observations of Mr. R. E. Dougherty of the American Railway Crossing Association and Mr. J. C. Brennan, vice president of the New York Central Railroad.

What improvements, if any, can be made in relief legislation in respect to highway construction?

The discussion of this subject was opened by H. G. Shirley of Virginia.

The conclusion was that due to uncertainty of any action by Congress relative to the temporary or permanance of character of relief funds used directly in highway construction and the possibility of this kind of assistance being of short duration, the committee did not feel warranted in offering any conclusion except that should further funds be made available by Congress for this purpose it should be cleared through the U. S. Bureau of Public Roads and the various state highway departments.

Should the Federal Government appropriate additional funds for surveys and studies of additional international highway connections with Canada and Mexico.

The discussion on this subject was opened by L. V. Murrow of Washington. Our conclusions developed from this discussion are embodied in a resolution presented to the resolutions committee.

Normal Trend of Business on Bay Bridge Indicated

VIEWING a decided drop in San Francisco-Oakland Bay Bridge traffic during January as a trend toward future normalcy, Director of Public Works Earl Lee Kelly submitted to Governor Frank F. Merriam and the California Toll Bridge Authority a report showing that the number of passenger autos using the transbay structure last month was 93,340 less than in December and that the number of passengers carried dropped off 20,385 as compared with the December total.

The only increased business during January was registered by truck trailers and in freight tonnage. One hundred and sixty-eight more truck trailers crossed the bridge last month than during December and freight transported increased 1,592,428 pounds.

Total collections on the bridge last month amounted to $447,146.17, a decrease of $63,053.90 as compared with December revenues.

NORMAL TREND EXPECTED

While an average of 21,634 vehicles used the great span in December the average for January was 18,551.

"During November," said Director Kelly, "the bridge enjoyed what we called sightseeing traffic, making that month from the date of the opening of the bridge on November 12 to its close the banner month. Holiday traffic during December and the sustained novelty of bridge travel held traffic figures to a high level during that month. January shows a trend toward normal traffic. We expect that the lowered bridge fares will result in an increase in business during February, after which we should see a steady normal traffic trend."

Comparative figures on bridge operations submitted to Director Kelly by Chief Engineer C. H. Purcell and contained in the report to the Toll Bridge Authority, were as follows:

	Jan.	Dec.
Passenger autos (including ambulances, taxis commercial and light delivery automobiles)	550,106	643,446
Auto trailers	545	813
Motorcycles	1,615	2,000
Tricars	402	405
Trucks	16,727	18,292
Truck trailers	1,458	1,290
Buses	4,230	4,405
Total vehicles	575,083	670,651
Extra passengers (including bus passengers)	93,119	113,504
Freight (lbs.)	34,394,571	32,802,143

Two Bridge Engineers Attain Higher Rank

TWO important changes in the executive personnel of the Bridge Department of the Department of Public Works have been announced by Director of Public Works Earl Lee Kelly.



F. W. PANHORST

Charles E. Andrew was elevated from the post of Bridge Engineer of the Division of Highways to that of Bridge Engineer in charge of the San Francisco-Oakland Bay Bridge, which he helped build. He has been succeded by F. W. Panhorst who, since September 1, 1931, when Mr. Andrew was transferred to duties in connection with the construction of the great San Francisco Bay span, acted as Bridge Engineer.

Born at Oregon, Illinois, Mr. Andrew graduated as a civil engineer from the University of Illinois in 1906, since which he has been identified with many important bridge projects in the West. For two years following his graduation he was assistant resident engineer on the Spokane, Portland & Seattle Railroad bridge across Willamette River at St. Johns, Oregon. He was city engineer of St. Johns from 1908 to 1913. He followed his profession in Oregon and Washington and in 1918 he was appointed bridge designer in the Portland office of the U. S. bureau of Public Roads. From 1920 to 1927 he was Bridge Engineer for the Washington Department of Highways. Since 1927 he has been Bridge Engineer of the California Division of Highways. He was in charge of all preliminary studies and borings for the San Francisco-Oakland Bay Bridge and of the design and construction of the huge structure.

Graduating from the University of Illinois in 1915 with B.S. and C.E. degrees, Mr. Panhorst entered the employ of the Pennsylvania Railroad as a designer in the bridge department. After several years experience as a bridge designer for various railroads, the Anaconda Copper Mining Company and the U. S. Navy, Mr. Panhorst went to the State of Washington where for six years he engaged in bridge construction work.

In 1927, Mr. Panhorst came to California and entered the service of the Division of Highways as construction engineer of bridges. He stepped naturally into the shoes of Mr. Andrew in 1931 when the latter was called to San Francisco Bay Bridge.

"SLOW GROUP" OF CALIFORNIA HIGHWAY SIGNS

(Continued from page 13)

The curve sign with symbol of right angle turn (3 or 4) is positioned in advance of curves of short radius, the symbol showing direction of turn.

The policy in deciding the proper curve sign is determined as follows:

Curves whose deflection angle (the angle turned proceeding from the straight line of approach around the curve on to the straight line of departure) is sixty degrees or over are marked with right angle curve signs (3 or 4); curves of less than sixty degrees, are marked with the 45° curve sign (5 or 6).

The tee symbol (7) is placed in advance of intersections of roads where the highway being traveled ends in another highway running at right angles, defined as a "T" intersection.

"California Highways" Color Film Creates Big Demand for Showings

By EDWARD J. NERON, Deputy Director of Public Works

SINCE its premiere showing in Sacramento on October 6, four months ago, the all-color film, "California Highways," portraying pictorially the history of road building in this State from the days of the Franciscan friars to the present, has fully justified the time and money expended in its production by the Division of Highways.

Designed to inform the people of California of the continual development of their splendid system of State highways made possible by the gas taxes they gladly contribute, the film has been exhibited in many cities throughout the State and requests for its showing are constantly increasing.

Two films are being shown at the present time in the east and the Department of Public Works has been unable to accede to all the requests for it that have been received from other States.

Recently, "California Highways" was given a showing in Mexico City with the result that the Mexican government has decided to produce a similar film depicting the scenic and other attractions on the newly-completed national highway from Laredo, Texas, to the capital city of the southern republic.

Exhibition of the film at the annual convention of the American Association of State Highway Officials in San Francisco last December was acclaimed as one of the highlights of the meeting by the delegates in attendance.

OTHER STATES IMPRESSED

A number of highway officials of other States were so enthused by the beauty of the picture and its advertising potentialities that they announced their intention of emulating California and producing an all-color film of their own State highways.

When Governor Frank F. Merriam and Director of Public Works Earl Lee Kelly gave their approval to the proposal of the Division of Highways that such a picture be made they did so with the thought in mind that the film would be a visual report to the payers of the gasoline tax that would graphically reveal to them how their money is being spent by the State on highways.

The film does just that. Its wide exhibition has borne out what Governor Merriam said of it at its premiere showing.

"This picture," the Governor said, "was worth while making because it will show Californians what becomes of the gas taxes they pay. It was worth while because this film will attract thousands of tourists to this State. It was worth while because many States already have asked that we loan them the picture for showing. Decidedly, it was worth while to produce this picture."

LOANED FOR EXHIBITIONS

In order that as many Californians as possible may be afforded an opportunity to view the film, the Department of Public Works has obtained four 35-millimeter copies of the film suitable for exhibition in theaters and several sets of 16-millimeter films which may be used by civic clubs, fraternal orders and similar organizations.

Theaters may have the film free for showing in their own standard projection machines. For the smaller size film the Division of Highways has portable projection machines which it sends with a trained operator to clubs, lodges, chambers of commerce and civic organizations desiring to view the picture.

"California Highways" is a film of especial charm. The picture consists of 355 separate scenes and its producers traveled over more than 11,000 miles of the State Highway System photographing in color mountain, valley and desert highways and their beautiful scenic attractions.

In cities and communities where the film has been exhibited the press has been fulsome in its praise of the picture. Typical of newspaper commendation is the following editorial which appeared in the Appeal-Democrat of Marysville following a recent showing of "California Highways" in that city:

Views of an Editor

"THOSE who saw the colored motion picture of California highways at the State theater got more adequate conception than ever before of the scope and quality of roads that have transformed the trails of pioneer days into modern thoroughfares. Even the average person's experience in driving the roads fails to impress upon him the composite view of our highways as well as this film does, for the motion picture knows no limits of time and distance.

"As we watch the unwinding of this all-color film we not only obtain a new comprehension of the road program and its infinite demands upon engineering skill and public financing, but we thrill with pride at the scenic beauties of California. It is a long-established fact that no other State is so replete with natural beauty, but this screen panorama brings conviction anew.

"IT IS TO BE HOPED THAT THE PICTURE IS GIVEN WIDE CIRCULATION OUTSIDE CALIFORNIA. IT IS SUFFICIENTLY ATTRACTIVE TO BRING THE WORLD TO OUR DOORS, ALTHOUGH A GOODLY PORTION OF THE WORLD ALREADY COMES THIS WAY AS OPPORTUNITY OFFERS.

Worth Investment

"Does the thought also obtrude that the interlacing system of concrete ribbons depicted on the screen has cost California a tremendous amount of money? What if it does? The result has been worth the investment. The highways we have built and are building, fine as they are, do not exceed the demands of modern transportation.

"And what if this investment had not been made, or had been held to a parsimonious minimum? Certainly we would not get the pleasure from driving which we do, and many of the most delightful regions would have remained isolated and inaccessible. But beyond that, we could not have attracted the millions of automobile tourists if we had nothing to offer them when they arrive.

"It is well to have such a picture as this to remind us of what fine roads mean to California. Frequently in the past efforts have been made to raid the funds with which these roads are built, and such attempts are by no means ended. When they recur it is well to realize that highways are one of our best investments and to be on guard against every suggestion of diversion. Governor Merriam and Public Works Director Kelly have done a fine thing in providing this film and the chamber of commerce and State theater are to be commended for arranging such an early showing here. California has never sent out a more eloquent exponent of its attractions."

Film Corporation Donates Valuable Right-of-Way

(Continued from page 8)

Improvement Association, City Engineer Lloyd Aldrich, and a legal representative of the Twentieth Century Fox Film Corporation, public announcement was made that the officials of this film corporation had donated a 100-foot right of way through the studio property along the alignment selected by City Engineer Aldrich and approved by the State. The studio officials also cooperated with the Janss Investment Corporation, and donated the right of way through the golf grounds between Heath Avenue and the studio grounds.

The city engineer in making his location through the studio grounds took advantage of a natural draw running along the north side of the new Will Rogers Memorial sound stage. By proper planting of trees and shrubbery along the sides of this canyon after the road is built, any noises developing along the traffic artery will be screened and dissipated so as not to interfere with work in the studio.

Dr. Davenport also reported the securing by donation of the 100-foot right of way from Granville Avenue in Los Angeles to Nebraska Avenue in Santa Monica, a distance of approximately one mile.

With this fine spirit of cooperation existing between the officials of the cities of Los Angeles and Santa Monica, the county of Los Angeles and the State of California, the public-spirited property owners and the energetic officials of the improvement associations above mentioned, it is hoped that continuous progress can be made on this important major traffic artery following a State highway route, No. 173, through the city, until the dream of a completed highway can be realized.

The total length of the Olympic Boulevard project from the east city limits of Los Angeles to Lincoln Boulevard in Santa Monica is 18.6 miles, of which 2.1 miles is in the city of Santa Monica, 1.6 miles in the city of Beverly Hills and 14.9 miles in the city of Los Angeles.

This mileage is distributed through the various cities as follows:

From Route 60, Lincoln Boulevard in Santa Monica to East City Limits Santa Monica—2.1 miles.

From East City Limits of Santa Monica to West City Limits of Beverly Hills (This area in the City Limits of Los Angeles)—3.5 miles.

From Heath Avenue, West City Limits of Beverly Hills, to the East City Limits of Beverly Hills near Robertson Boulevard—1.6 miles.

From East City Limits of Beverly Hills to East City Limits of Los Angeles at Indiana Street—11.4 miles.

Total length—18.6 miles.

Construction History of San Francisco Bay Bridge

(Continued from page 11)

Normal hard rock concrete was used. The upper deck is 6 inches thick and 58 feet wide. For the upper deck light weight concrete was used to reduce dead load. A locally manufactured product known as Gravelite was used, approximately 30 per cent of the sand content being normal hard rock sand. Concrete weighing approximately 100 pounds per cubic foot was obtained with an average strength of 3,000 pounds per square inch. In order to guard against traffic abrasion, a hard sand mortar top was used about one-quarter of an inch thick. All pavements were laid by means of a mechanical vibrating screed on a strike-off machine.

The average day's run was 225 cubic yards in place, with maximum day's of 350 cubic yards. The Hunt Process of curing was used.

Tile traffic lane markers were set as the concrete was laid in all light-weight concrete. These markers consist of 4¼ x 4¼-inch tile set flush with the pavement surface. A tile having less than one-half of 1 per cent absorption was specified to guard against discoloration by road oils.

In the way of research considerable work has been done. Early in the design of the bridge it was thought proper, and in some cases necessary, to make a considerable expenditure along this line. An expenditure of $50,000 was approved by R. F. C. to investigate the question of riveted joints. Considerable data was available in small sections, but heretofore no full-size large joints had been investigated. The extremely large riveted members and long rivet grips necessary in the San Francisco-Oakland Bay Bridge seemed to justify such an investigation.

The large testing machines at the University of Illinois and of California made it possible. These tests have been in process for some time at both the University of Illinois and the University of California and some very interesting results are being obtained. Full reports will be made by both of these institutions and I am sure they will be of great interest and use to bridge engineers in future bridge design.

Another problem which developed during construction was the question of long grip rivets. Inch and one-quarter rivets with grips up to eight inches were required and considerable concern was aroused as to whether or not these rivets were filling holes properly. To test this question several test blocks were made using grips of four and six inches including carbon and manganese rivets. In the first block riveters were allowed to use the equipment and method normally used. This block was then sawed along the rivet center line and rather unsatisfactory results were obtained.

Other test blocks were then made up, using heavier guns with various modifications of driving and "bucking up," also modifications of heat. Typical pictures of blocks will be shown later. The general result of the tests led to the decision that best results could be obtained by using heavier riveting guns and bucking up with combination riveting and bucking up tool. In the long grip rivets it was found necessary to heat rivets to a lemon color rather than the conventional cherry red. It is, of course, impossible to follow rules in detail in actual practice. The tests, however, were so obvious that riveting crews were impressed with the effectiveness of certain precautions and methods. We all know how riveting crews hate to cut out rivets and I am sure the tests had good effect. Some points were developed which might well be incorporated in future specifications.

In conclusion I can not say less than that our Director and our Chief need no commendation to you. Their ability and their personalities are known to all of you.

Our engineering and office organization from top to bottom deserve the highest commendation for the loyal service which they have performed. Chief engineers and bridge engineers can not build bridges without the men who actually do the work. Long hours have been worked and their best has been given. I am sure no better organization has ever been assembled.

Equal commendation is due to all contractors and their employees.

We still have to build the interurban terminals, yards, viaducts, bridge track and signal systems which will transport commuters across the bay. Eighteen months will be required and $15,000,000 additional will be spent. We are certain that the second stage of construction will be as efficiently and successfully completed as the first.

Operation of the vehicular crossing has been in process since the twelfth of November. During the first week of operation 320,000 vehicles crossed the bridge, with a maximum of 78,000 in one day and an average for three consecutive days of 67,000.

Four Additional Grade Crossing Projects Provided

SAVINGS effected in Works Progress grade separation projects in California for which the Federal government appropriated $7,318,141 involving 41 different undertakings have enabled the State Highway Commission to add four more grade crossing projects to its program, Director of Public Works Earl Lee Kelly has announced.

The additional grade separation work will cost $306,000 and finding that this amount will be available out of the original total government allocation the Highway Commission at its December meeting submitted to the U. S. Bureau of Public Roads a supplemental program calling for four projects in San Diego, Los Angeles and San Joaquin counties.

Director Kelly said he had been notified by State Highway Engineer C. H. Purcell that District Engineer C. H. Sweetser of the Bureau of Public Roads, San Francisco, has given his approval to the additional projects.

The sum of $195,000 will be spent to eliminate a grade crossing on San Gabriel Boulevard in Los Angeles at the point where the Union Pacific Railroad crosses the State highway at Pico. San Gabriel Boulevard is being developed into a main thoroughfare.

A major line change is being made in the State highway at San Onofre north of Oceanside in San Diego County and $85,000 will be expended to construct a concrete overhead where the Atchison, Topeka & Santa Fe crosses the highway.

SOLANO BEACH PROJECT

A concrete overhead to carry the Atchison, Topeka & Santa Fe across the county road at Solano Beach north of San Diego will be constructed at a cost of $20,000. The Solano Beach road connects with the State highway at the San Diego fair grounds.

The Central California Traction Company is removing its tracks on Wilson Way in the eastern section of Stockton and $6,000 will be devoted to repaving and widening that thoroughfare after removal of the tracks is accomplished.

An Appreciation

John W. Howe,
Editor, California Highways
and Public Works,
Sacramento, California.

Dear Mr. Howe:

I subscribe for many magazines, but the one I read most promptly and most thoroughly is the one I receive free, "California Highways and Public Works."

It is really quite a thrill to me to follow by its wonderful pictures and informative articles the progress of California's marvelous State Highway System, and the other great public works which the Department of Public Works is carrying out.

I think the Department through you is doing quite a wonderful thing by the publication of this magazine which you so ably edit. By it, citizens and taxpayers not only have the facts and figures of Highway budgets and expenditures, but, outside of these important but dry statistics, are told in a most interesting way of the great feats of engineering and construction going on as just a part of the day's work throughout the State.

I hope this magazine is widely circulated for I know it must be greatly appreciated by all who receive it.

Very sincerely yours,

(Signed)

JAMES M. BURKE,
Visalia, California.

State Highway Commissioner Stanton Feted on Birthday

Attending a meeting of the California Highway Commission at Sacramento on February 4th Commissioner Philip A. Stanton of Anaheim was the recipient of many congratulations on his sixty-ninth birthday.

The headquarters staff of the Department of Public Works tendered him a birthday party at the Senator Hotel that night. A huge cake with twenty-one lighted candles adorned the banquet table and the guest of honor blew out the candles with all the gusto of a six-year-old.

Among those present at the dinner were Director of Public Works Earl Lee Kelly, Assistant Director Justus F. Craemer, Deputy Director Edward J. Neron, Harry A. Hopkins, chairman of the California Highway Commission; State Highway Engineer C. H. Purcell, Highway Commissioner H. R. Judah, and Julien D. Roussel, secretary of the Highway Commission.

252,727 Tourist Autos Entered State Last Year

TWENTY-SEVEN foreign countries, four distant United States possessions and territories, and the forty-eight States of the Union were represented in the 252,727 nonresident cars that entered California in 1936.

This represents an increase of more than eighteen per cent over the 1935 total of 213,428, according to Director Ray Ingels of the Department of Motor Vehicles. The number of persons in the cars was given as 757,167 last year, an increase of twenty-three per cent over the 1935 total of 615,728.

Arizona headed the list with 19,345 cars, followed by Oregon with 17,300; Washington was third with 14,451, and Texas was fourth, when 12,551 automobiles entered from that State.

Delaware sent fewer cars than any other State—eighty-four—being surpassed by the Territory of Hawaii, 408, and the Republic of Panama, 116.

Canada led all foreign countries with 3,465. Mexico was second with 371. Two cars bearing Australian plates traveled half way round the world to reach California. Two also came from India.

Nonresident permits were issued to one or more visitors from each of the following distant points: Argentine, Austria, Chile, China, Costa Rica, Cuba, Czechoslovakia, Dutch West Indies, El Salvador, England, France, French Indo-China, Germany, Guam, Honduras, Jamaica, Philippines, Venezuela, and the West Indies.

Underpass Eliminates Dangerous Grade Crossing at Palo Alto

By IRWIN T. JOHNSON, Resident Engineer

THE new Embarcadero Road Underpass in Palo Alto was officially opened to the public recently by Harry A. Hopkins, Chairman of the California Highway Commission, at an impressive ceremony sponsored by the city of Palo Alto.

Mayor C. H. Judson acted as master of ceremonies, introducing the speakers who included Edward J. Neron, Deputy Director of Public Works. An informal luncheon was served the guests at noon on the Stanford campus and the Palo Alto High School Band and several troops of Boy Scouts enlivened the proceedings conducted at the new structure.

Mr. Hopkins graciously termed the Embarcadero Underpass the most thoroughly treated and architecturally pleasing of the new structures he had yet dedicated. Controller A. E. Roth of Stanford University, predicted that its construction would stimulate traffic flow to Embarcadero Road which, in a relatively short time, would handle more traffic than University Avenue in Palo Alto; becoming more and more a principal entrance to the campus and serving future urban development on the campus property.

The Embarcadero Road Underpass is located on an important lateral between the El Camino Real and the Bayshore Highway, at the crossing of the double-track line of the Coast Division of the Southern Pacific Company. Construction of the separation was effected by the Division of Highways, Bridge Department, under the Grade Separation Program of the Federal Government, the entire cost of the work being borne by the United States Government.

The situation confronting the department in its construction was complicated by the District High School adjacent to and west of the crossing, with over a thousand children using the crossing four times a day, and the location of the "Stadium" station of the railroad directly at the crossing.

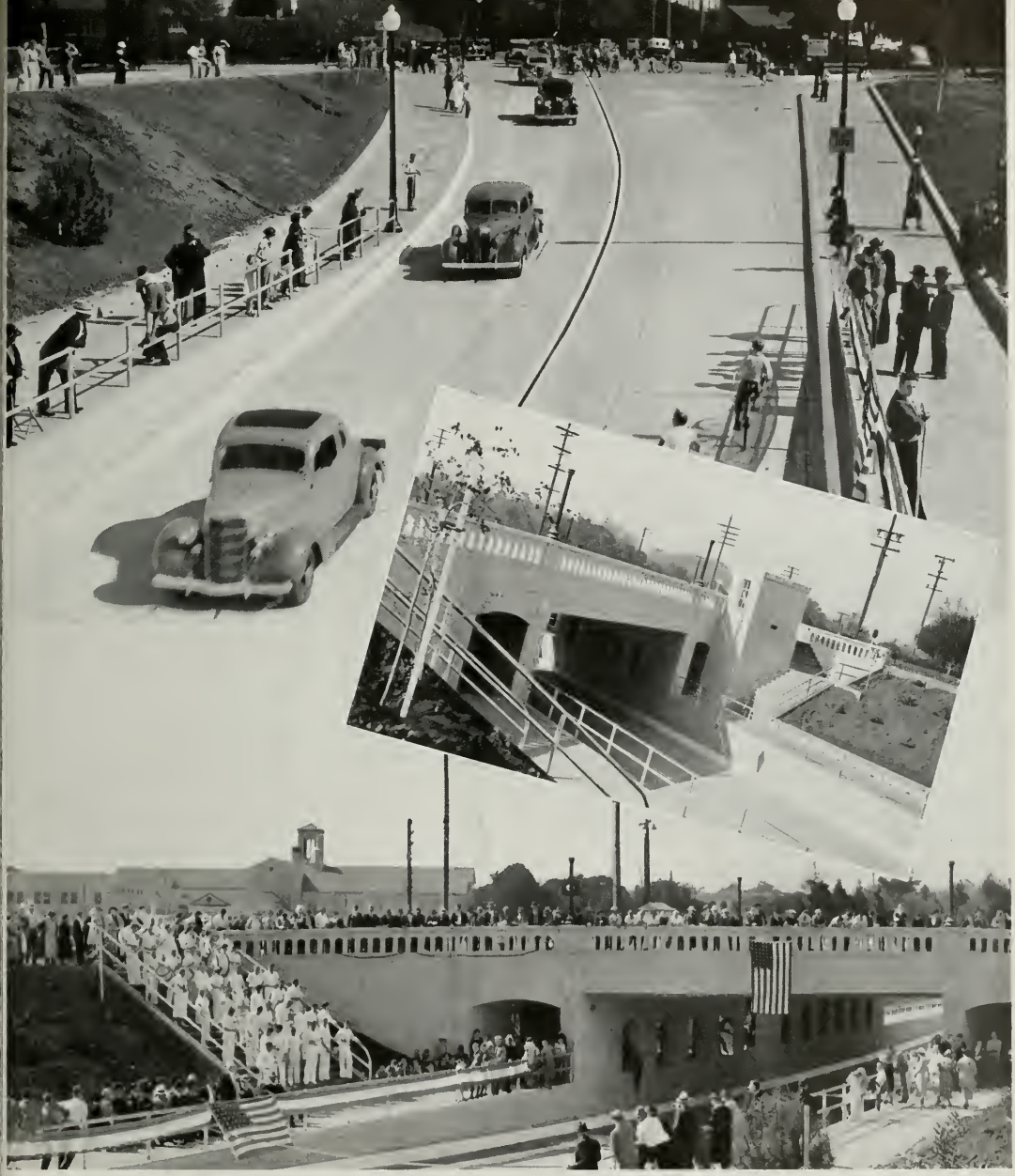
Included in the work of construction are ramp facilities at each side of Embarcadero Road for handling railroad passengers during football games without grade crossing; carrying Alma Street, paralleling the railroad, over the depressed roadway; revision of all underground utilities and sewers; and revisions to the existing streets and approaches.

The separation is constructed on an offset line through the depressed portion to take advantage of an existing city park and about an acre of the

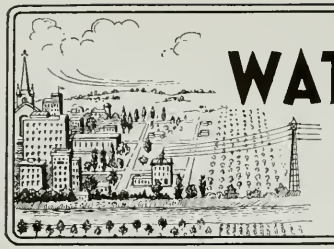
(Continued on page 26)



Official group at dedication of Embarcadero Underpass at Palo Alto: Left to right, Andrew W. Hoy; F. S. Miller, Assistant City Engineer; Col. Chas. B. Wing; C. E. Ashworth, chairman Palo Alto Planning Commission; Prof. E. C. Thomas, member City Council; O. F. Campbell, chairman Board of Public Works; Prof. E. L. Grant, Board of Public Works; Mayor C. H. Judson; Col Jno. H. Skeggs, District Engineer, State Division of Highways; Chairman Harry A. Hopkins, State Highway Commission; City Engineer J. F. Byxbee; Deputy Director Edward J. Neron, State Department of Public Works; G. G. Bertsche; G. D. Whittle, Bridge Engineer; L. H. Anderson, Deputy City Engineer; President D. A. Mendenhall, Chamber of Commerce; I. T. Johnson, Resident Engineer; Col. E. L. Hayden.



The Embarcadero Underpass at Palo Alto eliminates a dangerous traffic point formed by the intersection of the Southern Pacific main line tracks and the Embarcadero lateral connecting El Camino Real State Highway with the Bayshore Highway—a crossing daily used by a large number of high school pupils and Stanford students and by the large football crowds on game days to and from the adjoining Stadium Station. The underpass carries the Embarcadero roadway beneath the tracks of the railroad and the roadway of Alma Street both of which are accommodated on the structure above. The top picture shows the wide subway for the Embarcadero lateral swinging down to the underpass with pedestrian ramps on either side. Inset is a view of the structure that carries railroad and Alma Street over the subway. At bottom is the scene on dedication day showing the crowd at the speakers' stand and the high school band grouped on the steps.



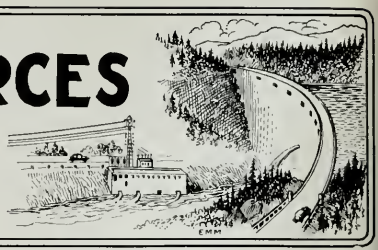
DIVISION OF WATER RESOURCES

OFFICIAL REPORT

FOR THE MONTH OF

January, 1937

EDWARD HYATT, State Engineer



Verification by the U. S. Bureau of Reclamation of the investigations of engineers of the Department of Public Works upon which the latter based their recommendations in favor of the Kennett dam site for the Central Valley Project was highly gratifying to Director of Public Works Earl Lee Kelly and the Water Project Authority of the State of California.

John C. Page, Commissioner, U. S. Bureau of Reclamation, reported to Secretary of the Interior Harold L. Ickes, that the storage reservoir on the Sacramento River will be constructed at the Kennett dam site, provided that satisfactory arrangements can be made promptly with the Southern Pacific Railway Company for moving its tracks from the reservoir site.

"The Bureau of Reclamation engineers have found that the Kennett site is unquestionably a safe site for a dam of a height sufficient to provide the storage that will be necessary," Mr. Page said. "The exact height of the dam to be constructed has not been determined; however, this will not delay the start of construction. The dam will at least be of a height sufficient to provide 3,000,000 acre feet of storage."

IRRIGATION DISTRICTS

Following investigations conducted in the proposed Exeter and Lindmore irrigation districts, favorable reports were submitted to the Board of Supervisors of Tulare County, as to feasibility of the projects, and recommendations made that organization elections be approved at final hearings. The districts plan to secure their water supply from the Friant-Kern Canal of the Central Valley Project.

Owens Valley Irrigation District in Inyo County was dissolved by court order on December 24, 1936, in an uncontested action brought by the Attorney General. The district has been inactive since acquisition of the water supply by the city of Los Angeles.

Loans recently authorized by the Reconstruction Finance Corporation to California irrigation districts include: Carmichael, $53,000, Citrus Heights, $86,000, and Paradise, $20,000.

Districts Securities Commission

The petition of La Mesa, Lemon Grove and Spring Valley Irrigation District for approval of a new bond issue in the amount of $145,000 was granted. The proceeds will be used for repairs on the distribution system.

SACRAMENTO FLOOD CONTROL PROJECT

Construction has been commenced by the War Department on the first units of the Bear River system. This includes a drainage collecting system north of the Bear River and east of the Western Pacific Railroad, and the levee on the north side of the Bear River between Carlin bridge and Dry Creek.

Flood Measurements and Gages

All of the thirty-five recording water stage stations under charge of this office are now in operation and in good condition. Several of the stations have been remodeled and practically all of them have been repaired. Radio sending equipment is being installed in the stations at Coloma on the south fork of the American River, Rattlesnake Bridge on the north fork of the American River, Nicolaus on the Feather River and Ord's Ferry on the Sacramento River.

FLOOD CONTROL AND RECLAMATION

Sacramento Flood Control Project

A small crew in the Sutter area has been engaged in routine maintenance work on drainage canals, levees and structures. Following the light rains the roads on the levees have been bladed with equipment borrowed from Sutter County. The canals tributary to pumping plant No. 3 have been cleaned by a dragline excavator, and the machine is now engaged on cleaning ditches tributary to pumping plant No. 2. An approach has been constructed at pumping plant No. 3 and additional material has been placed on the Wadsworth Canal levee near the Franklin Road bridge.

The south levee of the Sacramento Bypass and the road on top, near the drainage plant of District 785, have been repaired. During the past several years there has been slipping of material at this point following heavy rains. Fifty tons of rock were placed on the road surface.

Relief Labor Work

Clearing of the flood channels of the Feather River north of Marysville has proceeded with a relief labor crew of sixty men. This may be increased during February 1st to approximately one hundred men.

Forty relief labor men have been engaged in clearing in the Tisdale By-pass, operating out of the State Relief Administration Camp No. 7 in Reclamation District No. 1500. It is expected that this crew will be increased to eighty men shortly.

Bank Protection Program

Progress in the construction of permanent bank protection works on the Sacramento River under the State-Federal cooperative program of June, 1932, has been satisfactory. The whole program is approximately 90 per cent complete.

SUPERVISION OF DAMS

Application for enlargement of the Danhauser Dam was approved on January 15, 1937. The increase in height is approximately 2 feet and the increase in storage capacity about 350 acre feet.

Construction work on the San Gabriel Number 1 Dam of the Los Angeles County Flood Control District is progressing as is the work of the Metropolitan Water District on the Cajalco Dam.

Repair work on the Lake Hodges Dam has been completed.

Work on Grant Lake and Long Valley Dams of the City of Los Angeles has been discontinued because of climatic conditions. Work on the O'Shaughnessy Dam of the City of San Francisco has also been discontinued because of the weather.

Revised plans for the Gene Wash and Copper Basin dams of the Metropolitan Water District have been submitted and are under study.

The field work of the office has been somewhat curtailed during the past month because of weather conditions, although the usual maintenance and operation inspections have been made.

WATER RIGHTS

Supervision of Appropriation of Water

Twenty-five applications to appropriate water were received during December, 34 were denied and 21 were approved. During the month 20 permits were revoked, 5 were licensed and 1 license was revoked.

Two hundred and thirty reports were received during December from permittees and licensees. These reports are in process of study with a view to determining the proper course of action in each case.

Water Distribution

A financial statement for 1937 for each of the following water master districts has been prepared: Owl, Soldier, Emerson, Cedar, Deep and Mill Creek Water Master Distriets (in Surprise Valley, Modoc Connty); New Pine, Davis, and Franklin Creek Water Master Districts (in Goose Lake Valley, Modoc County); South Fork of Pit River, Pine Creek, Hot Springs Valley and Big Valley Water Master Districts (in Modoc and Lassen Counties); Shasta River Water Master District (in Siskiyou County); Hat, Burney and Cow Creek Water Master Districts (in Shasta County).

SACRAMENTO-SAN JOAQUIN WATER SUPERVISION

During the past month the activities of this office have been confined to office work in making ready data to publish a report showing the amount of water diverted from and returned to streams in the Sacramento-San Joaquin territory. The report will also show the amount of land irrigated, the flow in the stream channels and the rate of advance and retreat of salinity in the delta.

There has been no sustained increase in the flow in valley streams. The flow of the Sacramento River at Sacramento is about 5000 second feet.

There has been a slight reduction of salinity in the delta. Sampling is being carried on at certain key stations throughout the delta.

California Cooperative Snow Surveys

During December the first extended storms of the season blanketed the Sierra with snow. Temperatures during the storm periods were low and snow fell at very low elevations. The record cold weather following these storms has maintained the snow line at low elevations.

In the office, work has continued on a compilation of precipitation and runoff data and the working up of the natural flows that occurred during the past season. The actual historical figures compare well with those estimated in the April snow survey bulletin. One or two of these have as yet not been worked up, but they will be completed as soon as necessary data is received.

Preliminary work is being done preparatory to issuing the first snow survey bulletin of the year, scheduled for release about February 10th.

Federal Cooperation—Topographic Mapping

Progress was made during December in the topographic mapping of Avenal Quadrangle in San Luis Obispo and Santa Barbara Counties and there was some office work on the Downieville Quadrangle in Plumas and Sierra Counties.

Advance sheets of Yreka, Burney and Mt. Emma Quadrangles are now available. The first two are Federal sheets and the last was done by the U. S. Geological Survey in cooperation with Los Angeles County. The Yreka Quadrangle covers an area in Siskiyou County and is published on a scale of 1:96,000 with contour intervals of 50 and 100 feet. The Burney Quadrangle covers an area in Shasta County and is published on a scale of 1:96,000 with a contour interval of 100 feet. The Mt. Emma Quadrangle covers an area in Los Angeles County and is published on a scale of 1:24,000 with a contour interval of 25 feet.

Kennett Project Will Safeguard All Water Users

ASSURANCES that the Water Project Authority of the State of California will zealously guard the interests of all owners of land and water rights in the San Joaquin Valley in the construction of the Central Valley Project were given by Director of Public Works Earl Lee Kelly to representatives of many property holders and irrigation districts affected by the project at a recent meeting of the authority.

"The Central Valley Project," Director Kelly said, "is progressing quite satisfactorily. Since the January session of the authority three important and very gratifying developments have occurred. The Federal government has determined that the Kennett dam site is the most suitable for the project, thus verifying the investigations of our own engineers on the subject; the Contra Costa conduit unit of the project has been advertised for bids, and Mr. John C. Page has been appointed Commissioner of the United States Bureau of Reclamation. All of us have occasion to rejoice that these steps have been taken."

NO WATER DIVERSION

Some of the representatives of water users in the upper San Joaquin Valley expressed fear that if Friant Dam is completed before Kennett, dam water stored there would be diverted to points south in Tulare, Kern, and Kings counties to the detriment of the upper valley landowners.

"The Water Project Authority," Mr. Kelly declared, "never will approve of any move to divert water from one section of the State to another where such diversion would be harmful to any owner of water and land rights. The interests of all present holders of such rights will be carefully guarded. Friant Dam is only one unit of the main project. Kennett Dam is another, the Contra Costa conduit is another.

"All are component parts of the general project and the Water Project Authority, in looking forward to the completion of the whole undertaking, is determined to safeguard all existing water rights and to see to it that no section of the State benefits at the expense of any other section."

CENTRAL VALLEY PROJECT

Comparative studies of the alternative sites for the large storage reservoir on the Sacramento River, which is the key to the Central Valley project, indicate that the Kennett site is superior from an economic standpoint to the others, that its foundation is secure, and that a larger amount of hydro-electric power can be developed there than at either Table Mountain or Baird.

Commissioner Page of the U. S. Bureau of Reclamation informed Secretary Ickes that bids were being invited for the construction of the first four mile section of the Contra Costa Canal and that they would be opened on March 1st.

"It is gratifying," Secretary Ickes said, "that the complex preliminary work on the great Central Valley project is now drawing to a close; with the way now apparently cleared for the start of work in two divisions of the project, I anticipate construction to proceed rapidly."

WATER RESOURCES

South Coastal Basin Investigation

Good progress has been made in the field and office on the South Coastal Basin Investigation during the month of January.

San Luis Rey River

Work upon the report covering the investigation and survey of San Luis Rey River in San Diego County for the purpose of securing data and preparing plans for flood control, rectification of river channels and conservation and utilization of the waters of the San Luis Rey made by the Division of Water Resources in cooperation with WPA, City of Oceanside, County of San Diego and Carlsbad Mutual Water Company has continued during the month.

"Do you mean to say, sir, that Jock McGregor is a Scotchman you can't accuse of being tight with his money?"

"Yes, he always leaves it home when he goes out to get tight."

Underpass Eliminates Dangerous Grade Crossing at Palo Alto

(Continued from page 22)

high school grounds, and saved a considerable property damage to the city. The pedestrian ramps are built on 15% grades and are each about 80 feet long and 10 feet wide. The depressed roadway has a width of 32.5 feet and vertical clearance of 14 feet. Sidewalks are built on each side, 10 feet wide, carried through the abutments 8 feet wide. Below these abutment walks are large chambers used to store surface water during storms.

One of the interesting features of the work was the method devised to handle storm runoff. The only available storm sewer for discharge was a 10-inch pipe, already used to about 60% of its capacity. In order to have handled storm water without storage a pipe twice this size would have been required.

STORAGE CHAMBERS PROVIDED

It was decided to build these storage chambers under the abutments to store the peak runoff, based on flood intensity records. These chambers can store 93,500 gallons of water before the subway is flooded, although it is planned to store only about 70,000 gallons maximum, leaving a 33% factor of safety. A complicated system of stilling wells and float switches to the small discharge pump operate to permit ordinary street drainage to use the storm sewer during a rain storm, storing water under the abutments at the same time, thus preventing any flooded streets. As the level of this ordinary sewer flow drops to negligible point, the pump operates against a check valve set in the storm sewer. Where storm water rises to a dangerously high level in the storage chambers, the pump starts regardless of the elevation of the sewer flow, pumping against the check with the full capacity of the sewer.

TRAFFIC PROBLEM SOLVED

Provisions are made for three railroad tracks at the crossing, furnished with wide concrete sidewalks and concrete railings. Station platform facilities are provided for about 1000

(Continued on page 28)

New Bumpograph Devised for Asphalt Concrete Pavement

By E. L. SEITZ, Resident Engineer

ASPHALT concrete pavement requires close and accurate straight-edging during construction in order to find and eliminate all bumps while the material is still in a workable condition. In order to facilitate the locating of irregularities, several types of devices more or less crude in construction, have been built in District VII, both by field assistants on the job and by the district shop.

Under the author's direction, there has recently been constructed a device he terms a "bumpograph" which has proven of considerable value in finding the high spots in this type of pavement.

The device consists essentially of a wooden frame hinged in the middle and supported by a bicycle wheel at each end, with two wheels at the middle hinge. One end of the frame extends well beyond the middle, acting as the primary arm of a compound lever. No springs or weights are required and the weight of the machine has been reduced to about 30 lbs. as against about 80 lbs. for former devices. The hinge permits the machine to be folded so that it can be transported by auto.

MARKING CRAYON IMPORTANT

Successful operation of the bumpograph depends greatly on maintaining the marking crayon at a fixed position in respect to the crayon holder. After trying out a number of devices, it was found that the worm feed proved most satisfactory. A rubber wheel about two inches in diameter is attached to the end of the crayon holder so that the tread of the wheel bears against the pavement surface when the crayon arm is lowered to marking position. Rotation of this wheel turns a feed screw through the medium of a spiral gear on the axle of the wheel and a worm gear on the feed screw, and a lug fixed to a nut on the screw extends through a vertical slot in the crayon holder, so as to bear against the crayon and feed it downward through the holder.

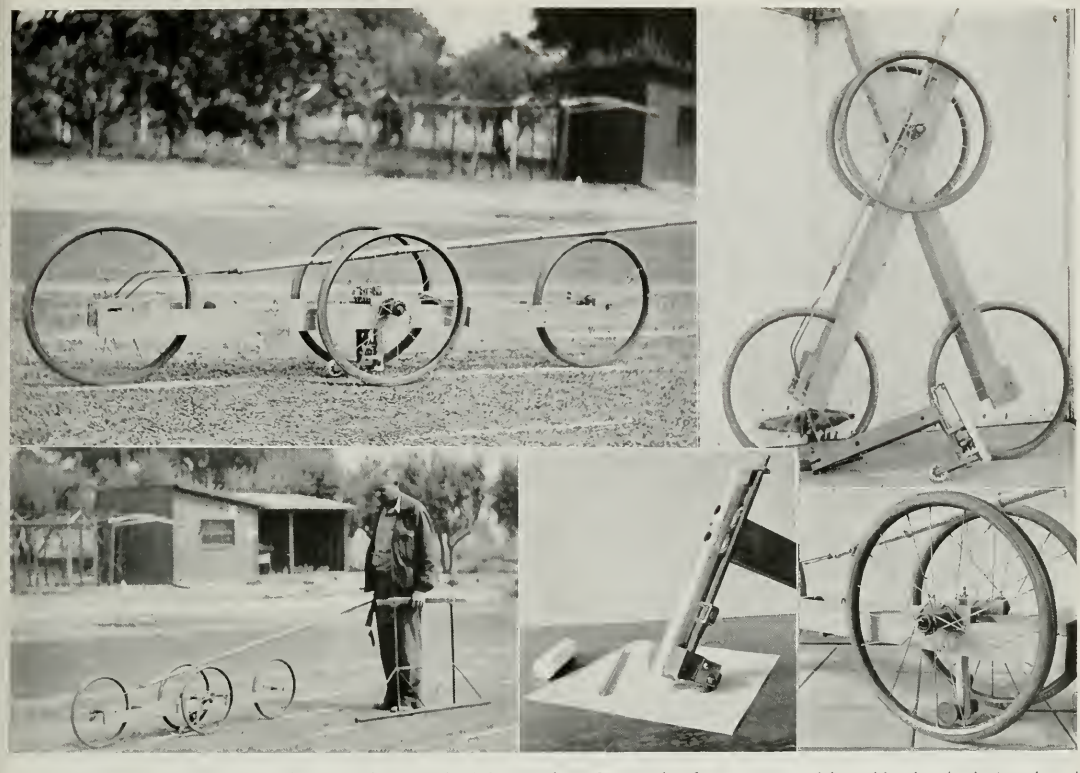
When the crayon has been fed down even with the tread of the wheel, it also bears on the pavement and tends to carry a part of the weight of the crayon arm and holder, and as the wheel is relieved of part of the weight there is insufficient traction to continue its rotation, and the crayon is fed only to that point even with the wheel. As the crayon wears away, the load is again transferred to the wheel and the crayon again fed downward. In this manner, the crayon is automatically kept at a fixed distance beyond the end of the holder and requires no attention except replacement.

Railroad crayon, 1 inch diameter by 4 inches long, has been found best for marking bumps, leaving a heavy white mark which does not fade out from pavement heat.

BUMPS EASILY MARKED

The bumpograph is positive in action and sufficiently sensitive to mark bumps $\frac{1}{16}$ inch high over a length of 5 feet or less. By means of an adjusting screw on the marker arm, the height of the bump to be marked can be selected. The adjustment is generally made so that $\frac{1}{8}$ inch bumps will be marked, and this is best done by wheeling the bumpograph over a given section, measuring the bumps marked with a straightedge and changing the adjusting screw until the desired height of the bump is marked.

Machines were first tried out with multiple marking arms, each arm being adjusted to mark bumps of different heights. By this means, the height of the bump was indicated by the number of marks. However, it has been found that when the bumpograph is sufficiently sensitive, the character of the marking will indicate not only the height of the bump but other characteristics as well.



"Bumpograph" devised by Resident Engineer E. L. Seitz consists of a wooden frame supported by a bicycle wheel at each end and two wheels at the middle hinge where marking device is located. At right, the machine folded for transportation. At bottom, Mr. Seitz operating the machine and carrying straight edge. At right, close-ups of marking device showing feed screw for crayon and device in position.

When the operator has learned to interpret the marks left by the bumpograph, much valuable information may be had.

Let us assume that the bumpograph has been adjusted to mark a minimum bump of ¼ inch and has been wheeled over a section of pavement on paths 2 feet to 3 feet apart for the full width of the pavement. If a short mark of 1 foot or less is made, possibly formed by a roller stop, one or two passes with the cross-roller will iron it out. Two or three foot marks showing ½ inch to ¾ inch bumps indicate a change in load against one or both sereeds of the spreading machine, and will require five or more roller passes. If marks are longer near one header, there will be a high spot in this header.

Occasionally, marks 10 feet or more long with ½ inch deep bumps are found, possibly formed by a machine stop, a cold load, or a high header. Rolling should then be started in the center and edged over a foot or more toward the end of the bump with each successive pass of the roller, then go back to the center and edge over toward the other end. This will spread the bump both ways instead of crowding it to the center, and it may be necessary to repeat this operation several times to perform a good job. If the pavement is getting cold, it may be necessary to get another roller to iron out before the pavement sets up ahead.

To date this deviee has been used in several districts, but its development has reached a point where it may be advisable to distribute it to other districts. Only one machine is available and the mechanical construction is not entirely perfected. The joints become loose and there appears to be some lost motion which might affect the accuracy of operation. However, it has proved of considerable value in constructing asphalt pavements wherever used.

Plan for Conservation Week

The Division of Highways of the Department of Public Works is cooperating with the California Conservation Council in plans for the observance of California Conservation Week, March 7 to 14.

The purpose of the Council is to promote an all-year educational program to arouse public interest in the conservation of the State's natural resources, improvement of roadsides and the preservation of natural landscapes, a work in which the Division of Highways, through its Roadside Development unit, is vitally interested.

Underpass Eliminates Dangerous Grade Crossing at Palo Alto

(Continued from page 26)

feet on each side of the tracks. Two flights of concrete stairs beside the separated street grades provide for full use of the separation for all pedestrian uses. An extensive landscaping plan was executed under the contract, together with an ornamental illuminating system throughout the project area.

Immediate effect was noted upon opening the separation, both for pedestrian and vehicular traffic. All normal pedestrian traffic to the high school and the university used the walks provided without direction or congestion, while vehicular traffic found the roadway adequate and convenient.

The crowds attending the football game on October 24th, last, estimated at some 50,000 persons and about 15,000 to 20,000 cars, used the separation in an orderly manner under the direction of the Palo Alto Police Department and the State Highway Patrol, while the railroad company handled all rail traffic at the stadium station with loud-speaker direction. A decided improvement was noted in dispersing the vehicular traffic from the stadium area to all bay district areas. The local traffic situation was returned to normal conditions in less than an hour.

MUCH EMPLOYMENT PROVIDED

The contract for the project was executed by Eaton and Smith of San Francisco, who are at present engaged in constructing the Niles Project described in a recent issue, of California Highways and Public Works. The principal items of construction cost were:

4,600	cu. yds. of ready mixed concrete
261,000	lbs. bar reinforcement
240,000	lbs. structural steel
60	MBM lumber
40,000	sq. ft. plywood
18,000	gals. gasoline
$2,500	electrical equipment
$1,000	plants and shrubs

Some 44,689 man hours of employment were provided by this work, totaling a payroll of $38,687.39, by direct construction. Materials necessary to complete the work total approximately $65,000 in cost, of which amount a large proportion went for production payroll. In addition to these amounts, the railroad was reimbursed for approximately $20,000 of labor and material costs expended.

The entire project was designed and constructed by the Division of Highways, C. H. Purcell, State Highway Engineer, and F. W. Panhorst, Bridge Engineer. H. H. Gilbert designed the work, and the writer served in the capacity of construction engineer until the completion of the entire project.

In Memoriam

FRANCIS GEORGE DARLINGTON

District IV loses a valuable assistant from its ranks in the recent passing of Francis George Darlington, Associate Highway Engineer, at his home in the city of Palo Alto on January 7, 1937.

Mr. Darlington was born in Liverpool, England, on April 3, 1885, but while very young his parents moved to the United States to make this country their permanent home.

Frank, as he was known to all his friends, received his education in the public schools of Milwaukee, Wisconsin, and in the State University at Madison, but the San Francisco Bay region was his home from early manhood to the day of his passing.

Mr. Darlington filled various field and office positions from March, 1908, to October, 1918, in the City of San Francisco's Engineering Department, from which service he resigned to become a First Lieutenant in the U. S. Army Engineering Corps, where he served until January, 1919. In November, 1919, Mr. Darlington began his service with the Division of Highways in District IV, where he was employed for a time on field surveys until called to the office where his versatile talents and alertness proved a great value in assisting the Chief Draftsman in office work of the District organization.

During this seventeen years of State service, Frank Darlington accomplished a vast amount of work. His kindness, consideration and helpfulness to others were outstanding characteristics. Fidelity to principle and gentleness of spirit were predominant in his character.

His passing in the prime of his life was a shock to his many friends and leaves a profound sense of loss.

Highway Bids and Contract Awards During January

HUMBOLDT COUNTY—Between Trinidad and McNeills Ranch, 2.3 miles to be graded and surfaced with road-mix surfacing. District I, Route 1, Section J. Hemstreet and Bell, Marysville, $111,991.30; Fredrickson & Watson Const. Co. and Fredrickson Bros., Oakland, $111,302.84; A. Teichert & Son, Inc., Sacramento, $116,963; Mercer, Fraser Co., Eureka, $117,803.50; Fredricksen & Westbrook, Lower Lake, $119,034.80; Hanrahan Co., San Francisco, $135,361.95; Harms Bros., Litchfield, $136,826. Contract awarded to Poulos & McEwen, Sacramento, $104,316.60.

IMPERIAL COUNTY—Between Sandia and Alamo River, 10.1 miles to be graded and surfaced with plant-mixed surfacing. District XI, Imperial County, Sections B, C. V. R. Dennis Const. Co., San Diego, $99,001.70; Basich Bros., Torrance, $98,337.40; Dimmitt & Taylor, Los Angeles, $95,007.10; Oswald Bros., Los Angeles, $84,637.75; B. G. Carroll, San Diego, $94,566.30; R. E. Hazard & Sons, San Diego, $88,640.75. Contract awarded to G. W. Ellis, North Hollywood, $78,029.55.

IMPERIAL COUNTY—Between Calexico and 3.1 miles easterly, 3.1 miles to be graded and surfaced with gravel base and plant-mixed surfacing and two timber bridges to be constructed. District XI, Route 202, Section C1x,C. V. R. Dennis Construction Co., San Diego, $89,047.35; Oswald Bros., Los Angeles, $83,916.85. Contract awarded to R. E. Hazard & Sons, San Diego, $79,968.70.

LOS ANGELES COUNTY—Between Azusa Avenue and San Gabriel River Bridge, 2.1 miles to be graded and surfaced with plant-mixed surfacing. District VII, Route 62, Section Azu, A. Geo. J. Bock Co., Los Angeles, $112,728.50; Dimmitt & Taylor, Los Angeles, $129,486; J. E. Haddock, Ltd., Pasadena, $104,916.50; Oswald Bros., Los Angeles, $110,930; Griffith Co., Los Angeles, $129,210.50. Contract awarded to A. S. Vinnell Co., Los Angeles, $98,545.50.

LOS ANGELES COUNTY—Between Playa Street and Washington Boulevard, 1.6 miles to be graded and paved with P. C. C. District VII, Route 158, Sections B, LA, Cl.C. Matich Bros., Elsinore, $92,199; P. J. Akmadzich, Los Angeles, $100,698.50; Geo. R. Curtis Paving Co., Los Angeles, $103,462; Griffith Co., Los Angeles, $99,993.20; C. O. Sparks & Mundo Engineering Co., Los Angeles, $107,518; Oswald Bros., Los Angeles, $95,758. Contract awarded to J. E. Haddock, Ltd., Pasadena, $91,784.50.

ROAD PROGRAM MADE WORK

The highway program to relieve unemployment administered by the Bureau of Public Roads of the U. S. Department of Agriculture had resulted in the construction of 38,220 miles of road at the close of the last fiscal year, according to the annual report of the Bureau, just released. These roads cost $636,622,561, of which $571,276,033 was paid by the Federal government, says Thos. H. MacDonald, chief of the bureau.

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Kennett Dam, Key Unit of Central Valley Project

Official Journal of the Department of Public Works

MARCH 1937

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways of the Department of Public Works, State of California

EARL LEE KELLY, Director | C. H. PURCELL, State Highway Engineer | JOHN W. HOWE, Editor

Published for information of the members of the department and the citizens of California

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Central Valley Project Unit Bids Opened. Kennett Dam Site Approved by U. S.

By EARL LEE KELLY, Director of Public Works

THE past few months have witnessed developments of major importance in the progress of the Central Valley Project promising an early start in actual construction operations. The final selection and approval of the Kennett dam site on the upper Sacramento River, the receiving of bids on initial construction contracts, the completion of preliminary steps in the negotiations for the necessary acquisition of water rights on the San Joaquin River, and increasing demands for electric power in northern and central California which point to a ready market for the hydroelectric power to be produced at Kennett, are some of the outstanding developments which have occurred.

In an undertaking of the magnitude of the Central Valley Project, the problems involved preparatory to actual construction getting under way are unusual in number and complexity. The necessary surveys and explorations which must be made prior to the preparation of final plans and specifications alone present problems of unusual magnitude.

ABOUT TO LET CONTRACTS

But in addition to the engineering problems involved in the preparation of plans for the several physical units of the project, there are legal, economic and financial problems to be solved which in some instances involve even greater difficulties. It is gratifying therefore, to realize that these preparatory phases of the work have now reached a point when contracts for actual construction work are about to be let and there is promise that additional construction contracts will follow shortly.

Following several years of constant endeavor to obtain Federal recognition and financing of the project, the first allocation of Federal funds for construction of the project was announced by President Roosevelt on September 10, 1935, in the amount of $20,000,000 from the Emergency Relief Appropriation of 1935. This was superseded by a second executive order issued by the President on November 16, 1935, which in effect provided $15,000,000 to start construction of the storage reservoirs on both the Sacramento and San Joaquin rivers and other units of the project. On December 2, 1935, President Roosevelt approved the recommendation of Secretary of Interior Harold L. Ickes, that the Central Valley Project be constructed as a Federal reclamation undertaking, declaring it to be "feasible from engineering, financial and agricultural standing."

$6,000,000 FOR FRIANT

In addition to the allocation of funds by President Roosevelt, the 74th Congress in the first Deficiency Bill passed in June, 1936, appropriated $6,900,000 for the continuation of the project with the provision that $6,000,000 be used for the construction of Friant reservoir and irrigation facilities therefrom in the San Joaquin Basin.

It is understood that the Presidential allocation has been reduced until it now stands at $4,500,000. Hence, there is apparently on hand at the present time $11,400,000 less expenditures made for preparatory work to date. These funds will be available until June 30, 1937, and present indications are that these will be either actually spent or encumbered before that date.

It is specified that the funds allocated and appropriated to the project shall be reimbursable in accordance with the Reclamation Laws, which by precedent will require execution of contracts providing for repayment in forty years. President Roosevelt officially approved the beginning of construction before repayment contracts are executed.

PREPARATORY WORK STARTED

A little over a year has elapsed since work was started on the Central Valley Project by the Federal Government. Starting in November, 1935, the United States Bureau of Reclamation, designated as the construction agency, has since been actively engaged in the investigations and studies preparatory to construction. A force of 200 to 300 men have been employed on the work in California under the direction of Walker R. Young, Construction Engineer, with the headquarters office in Sacramento.

In addition to the final location survey covering the dam sites, reservoir basins and conduit units and detail explorations of the dam sites, the Bureau of Reclamation has been making comprehensive engineering studies to check the plans for the project as formulated by the State. At the same time work has been proceeding on the preparation of final plans and specifications, appraisal of rights of way and water rights and the negotiations for their acquisition.

The Water Project Authority of the State of California is actively assisting and cooperating with the Bureau as the official administrative agency of the State, created by the Central Valley Project Act of 1933 and charged with the responsibility

of constructing the Central Valley Project. This administrative agency as designated by law comprises the Director of Finance, the Attorney General, the State Treasurer, the State Controller and the Director of Public Works.

WATER AUTHORITY PERSONNEL

In addition to the writer who has the honor to be its chairman, its present membership comprises A. E. Stockburger, U. S. Webb, Chas. G. Johnson and Harry B. Riley. The State Engineer, Edward Hyatt, is Executive Officer of the Authority and Deputy State Engineer A. D. Edmonston is acting secretary. The technical work of the Authority is handled by the engineering staff of the Division of Water Resources of the State Department of Public Works, under the State Engineer.

The work of the State has included not only the designation and approval of the general engineering plans for the project, but also the negotiations for the acquisition of water rights and rights of way. Other important activities are concerned with the disposal and sale of water and electric power to be made available by the project. In addition the Water Project Authority has been diligently continuing efforts directed to the securing of further appropriations and necessary authorizations from the Federal Government to continue the construction of the project expeditiously.

KENNETT DAM SITE APPROVED

One of the most important events in the progress of the Central Valley Project was the final selection and approval of the Kennett dam site for the storage unit on the Sacramento River, announced by Mr. John C. Page, Commissioner of the Bureau of Reclamation, from Washington, D. C., on January 25, 1937.

With the initiation of work on the project by the Bureau of Reclamation in November, 1935, some of the earliest work undertaken was the extension of explorations at the Kennett dam site. Additional explorations were essential before final designs could be prepared. At the same time the bureau engineers considered it advisable to investigate other sites for storage on the upper Sacramento River. Accordingly, explorations were extended in great detail at the Kennett site and two other sites, the Table Mountain dam site located between Redding and Red Bluff, and the Baird dam site located immediately below the confluence of the McCloud and Pit rivers, were also explored.

At the Kennett dam site alone, the exploration work of the bureau has included 5663 lineal feet of tunnels and shafts, 7358 lineal feet of diamond drill core borings, and 187.5 feet of special Calyx drill borings with cores 3 feet in diameter. This is in addition to the preliminary exploratory work by the State which involved 1415 lineal feet of tunnels and 4299 lineal feet of diamond drill borings.

FINAL SELECTION GRATIFYING

Exploratory work on these three sites was not completed sufficiently for a final determination of feasibility and comparative merits until December, 1936. Although the bureau's consulting board concluded that a dam could be built at any of the three sites considered, the economic analyses made by the bureau led to the final conclusion announced by Commissioner Page that the Kennett dam site is "superior from an economic standpoint."

The final selection and approval by the Bureau of Reclamation of the Kennett dam site for the storage unit on the Sacramento River is most gratifying, as it completely vindicates the State Engineer in his selection of this great reservoir as the key unit of the project. Kennett Dam and Reservoir was selected as the major storage unit of the Central Valley Project by the State Engineer in the report to the State Legislature in 1931, as a result of intensive investigations and studies carried on over a period of ten years.

All possible reservoir sites in the Sacramento River Basin, including those on the main tributaries as well as on the main stream, were carefully considered. Funds were not available during the State's investigations to carry out explorations to the extent required under modern engineering standards before dams of the tremendous size of Kennett Dam can be properly designed and constructed.

OTHER SITES EXPLORED

However, a considerable amount of exploratory work including tunnels and borings was carried out by the State and additional explorations were made by the United States Army Engineers to determine the sufficiency of the foundation and the cost of con-

Low Bids Received on Initial Contracts

Initial contracts covering actual construction of works for the Central Valley Project were advertised for bids in January and early February of this year. They cover in general two items: first, construction of the first 4 miles of the Contra Costa Conduit; and second, construction of camp facilities at the Friant dam site.

The following summarizes the data on the low bids received on each contract:

Description of work	*Date of bid*	*Name of low bidder*	*Amount bid*
Contra Costa Conduit (first 4 miles)	March 1, 1937	Haas, Doughty & Jones and Marshall & Stacy, San Francisco	$102,646
Office Bldg., Dormitories and Residences Schedules 1 and 2	March 5, 1937	Guy E. Hall, Los Angeles	44,021
Schedule 3		Lawson Constr. Co., Los Angeles	44,385
Steel Tank	March 3, 1937	Western Pipe and Steel Co., San Francisco	3,350
Duplex Cottages	March 4, 1937	Lawson Constr. Co., Los Angeles	63,043
Testing Laboratory, Garage and Fire House	March 6, 1937	A. C. Tornell, Tracy	17,195
Streets, Water and Sewer Systems, etc.	March 15, 1937	A. J. Clausen, Berkeley	24,967



Typical area of irrigated orchards and vineyards in Tulare County, flourishing before the water supplies were exhausted. This view was taken in 1923.



The same area as the picture above viewed in 1936. Trees and vines have died and been removed due to failure of water supply. 200,000 to 400,000 acres of highly developed and producing lands will be saved from a like fate by water supplies to be furnished by the Central Valley Project.

structing a dam. Explorations were also made at the Table Mountain dam site which was selected by the State during the preliminary investigations as worthy of consideration. The Baird dam site was also investigated, but owing to a lack of funds was not explored.

These original studies and investigations were reviewed by eminent consulting engineers employed by the State and also by the engineers of the United States War Department who rendered further material assistance by carrying out additional explorations at that time.

The Kennett dam site was chosen by the State as a result of the preliminary studies and investigations on the basis of a clear showing of its greater economy and superiority in accomplishments as compared to any other possible storage site. The more extensive investigations made by the bureau during the past year also have been reviewed by a Board of Consulting Engineers employed by the



Calyx core drilling machine used to explore the rock foundations at the Kennett dam site. This drill removes a core of rock 3 feet in diameter, permitting a man to be lowered into the hole to examine the rock in place.

State. The conclusion reached by this Board substantiates the original conclusions as to the superiority of the Kennett site.

RAILROAD TO BE MOVED

The selection of the Kennett site as announced by Commissioner Page is conditioned upon the working out of satisfactory and prompt arrangements with the Southern Pacific Company for removing 22 miles of railroad from the reservoir site and relocating it at a higher elevation. However, it is believed that there should be no undue delay on this account. The Southern Pacific Company already has expressed its willingness to the proposed change. Final location surveys have been completed for the new route and plans and specifications have been prepared. Contracts can be advertised for the construction of the railroad in its new location as soon as a satisfactory agreement is arranged.

The storage capacity of Kennett reservoir and the height of dam therefor has not been finally decided as yet. However, at least, 3,000,000 acre-feet of storage will be provided requiring a dam about 420 feet in height above low water. The dam will be constructed of concrete and will involve a mass of masonry comparable to that in the recently completed Boulder Dam on the Colorado River.

RESERVOIR VITAL UNIT

Kennett reservoir is the most vital unit of the project because it will furnish the bulk of the water which will be made able in both the Sacramento and San Joaquin valleys. It will be operated for many useful purposes. A portion of its capacity will be reserved during the winter and early spring months for control of floods, thus reducing flood flows and providing increased flood protection to the lands and communities subject to flood hazards bordering the Sacramento River.

Waters released from the reservoir will flow down the Sacramento River, providing first, a full supply for all rights to the use of water from the Sacramento River; second, sufficient water to maintain adequate depths for commercial navigation as far up stream as Chico Landing and possibly to Red Bluff if coupled with additional channel improvement; third, a full supply to meet all of the demands in the Sacramento-San Joaquin delta area, including a sufficient flow to maintain fresh water in the delta channels and prevent invasion of salt water thereinto; fourth, a supply for industrial, municipal and agricultural purposes in the upper San Francisco Bay area; and finally fifth, sufficient water for exportation to the San Joaquin Valley to adequately meet the deficiencies in water supply in the areas facing abandonment through water shortage.

INITIAL CONSTRUCTION CONTRACTS

Initial contracts covering actual construction of works for the Central Valley Project were advertised for bids in January and early February of this year. They cover in general two items; first, construction of the first 4 miles of the Contra Costa Conduit; and second, construction of camp facilities at the Friant dam site.

The Contra Costa Conduit is designed to furnish urgently needed water supplies to industries, municipalities and agricultural and suburban lands in a portion of Contra Costa County. It will serve an area of 50,000 to 60,000 acres mostly within the recently organized Contra Costa County Water District, embracing the lands fronting the lower San Joaquin River and Suisun Bay between Oakley and Crockett, and the Ygnacio and Clayton valleys, and including the cities of Antioch, Pittsburg, Martinez and Concord.

This section of Contra Costa County is notable for its heavy industrial development with industries producing products of over $100,000,000 in annual value. It also contains a large acreage of agricultural lands already highly developed largely to orchards and vineyards. The conduit will have a capacity in the initial section of 275 second-feet, a length of about 50 miles, and will require pumping plants to lift the water to an elevation sufficient for delivery to the area to be served.

ACQUISITION OF WATER RIGHTS

The plans for the Central Valley Project for utilizing the flow of the San Joaquin River, by storage regulation in Friant Reservoir and diversion therefrom through the Madera and Friant-Kern canals, to serve the areas of deficient water supply in the upper San Joaquin valley, require as a prerequisite the acquisition of the present rights to the use of these waters.

The plans contemplate: first, the purchase of the rights to water now used and appertaining to so-called "grass lands" irrigated for pasture; second, acquisition of the right to utilize the water now used on and appertaining to lands irrigated for crops, by providing in exchange therefor a substitutional water supply furnished by and through the San Joaquin pumping system; and third, acquisition of the right to utilize surplus waters, by appropriation or by compensating such interests as may have valid claims thereto.

The policy of the Water Project Authority is and will be to settle with the owners

of all water rights affected on a fair and equitable basis.

One of the most important responsibilities of the Water Project Authority has been the negotiations for acquisition of these water rights on the San Joaquin River. In preparation for these negotiations, many months of intensive surveys, investigations and studies have been required to obtain the basic facts as to the present use of these waters, and to define and determine the ownership and validity of the rights thereto. These surveys and studies have been confined chiefly to the portion of the San Joaquin River between Friant and the month of Merced River.

NEGOTIATIONS NOW PROCEEDING

Conferences have been held and preliminary negotiations have been initiated with several of the owners of the water rights proposed to be acquired. The bulk of the grass land water rights proposed to be purchased are owned and controlled by Miller & Lux, Incorporated, and affiliated companies. These interests also own or control lands assumed to be riparian and having rights to uncontrolled surplus waters.

As a result of extended negotiations, a proposed contract has been drafted for purchase of these Miller & Lux rights. This proposed contract, as submitted by Miller & Lux, Incorporated, is now being considered by the Bureau of Reclamation. It contains a definite offer from Miller & Lux to sell the rights specified for $2,500,000. The Water Project Authority at a special meeting on February 4, 1937, approved the form of contract and the terms and conditions contained therein without giving any expression as to the reasonableness of the asking price.

KENNETT HYDROELECTRIC PLANT

Incidental to the main objective of Kennett reservoir of furnishing urgently needed water supplies for many purposes, a large amount of hydroelectric power will be generated by the waters released therefrom. Present plans call for an installation of about 300,000 kilovolt amperes. This hydroelectric plant will be capable of generating on the average annually about a billion and a half kilowatt hours of electric energy. A transmission line will extend from the plant about 200 miles to the vicinity of Antioch which is the approximate load center of the northern California power market. About one-sixth of the output will be required in the operation of the project for pumping in the San Joaquin Pumping System and the Contra Costa Conduit. The balance will be available for disposal in the general power market.

MARKET FOR KENNETT POWER

It is anticipated that there will be a ready market for Kennett power when it becomes available. The electric power demands in northern and central California have been rapidly increasing during the past two years already requiring the provision of additional output capacity. Studies made by the State indicate that the entire power output from Kennett can be absorbed within a period of six to eight years after it becomes available.

The Central Valley Project Act of 1933 contains specific provisions governing the disposal and sale of electric power to be produced by the project. Under the terms of the act, power may be sold to privately owned electric utilities as well as municipalities and other public agencies, but preference is granted to municipalities and public agencies in the case of equivalent offers considering the cost of facilities required for delivery.

REQUESTS ALREADY RECEIVED

Preliminary requests have been received from several municipalities and public agencies and also from the Pacific Gas & Electric Company for the power to be produced at Kennett when it becomes available. Among the public agencies from which requests have been received are the cities of Redding, Sacramento, Lodi, and Stockton, Sacramento Municipal Utility District, the Bidwell Utility District, Reclamation District 2068, El Camino Irrigation District, and the East Contra Costa Irrigation District. In addition, several other irrigation and reclamation districts have indicated a desire to obtain power.

Recently in a communication received from President James B. Black of the Pacific Gas & Electric Company, the company states its readiness and willingness to take delivery of all the electric power that can be produced at the Kennett plant. It is apparent, therefore, that the hydroelectric power output at Kennett will find a ready market and that the revenues from the sale of power to be produced by the Central Valley Project will be fully realized as anticipated.

Careful engineering investigations and studies will be made of methods of disposal of Kennett power including a consideration of the general plans and costs of facilities required and determination of rates to be charged. It is essential that the power output be disposed of as rapidly as possible after it becomes available. To realize this objective, it may prove financially advantageous to the project for the electric power therefrom to be disposed of partly to public agencies and partly to the privately owned electric utility, but with the preferential



Three foot diameter cores taken out by Calyx drill at Kennett dam site typifying the hard solid rock foundation upon which Kennett dam will be placed.

rights granted public agencies in Central Valley Project Act receiving first recognition.

PRESIDENT RECOMMENDS $15,000,000

President Roosevelt in his budget message to Congress has recommended an additional appropriation of $15,000,000 to carry on the construction of the Central Valley Project. This recommended appropriation is now being considered for action at the present session of Congress. The Congressional representatives of California have expressed confidence that favorable action may be expected.

It is most gratifying that the Central Valley Project has a staunch supporter in Mr. John C. Page who was appointed Commissioner of the Bureau Reclamation by the President on January 25, 1937. Mr. Page previously had been Acting Commissioner following the death of Dr. Elwood Mead in January, 1936. He is thoroughly familiar with the conditions in California, has a keen realization of the water problems which must be solved and the vital necessity of the Central Valley Project. He has been quoted as stating: "I think the Central Valley Project will do more good than any other project ever undertaken by the Federal Government."

Commissioner Page is a man of action. The important developments in the progress of the Central Valley Project since the first of the year, including the final selection and approval of the Kennett dam site and the receiving of bids for intial construction contracts, have come since his appointment as Commissioner.

Increase In Autos

An increase of 8.9 per cent in the number of automobiles registered in California in 1936, as compared with 1935, is announced by Howard E. Deems, registrar of vehicles.

In 1935 the total was 2,015,018, and in 1936 it was 2,178,038.

Registration of all fee paid vehicles jumped from 2,254,828 in 1935 to 2,448,925 in 1936, an increase of 8.16 per cent. Motorcycles increased from 8861 to 9816, an increase of 10.78 per cent. Pneumatic trailers showed an increase of 19.58 per cent increasing from 88,814 to 106,204. Solid tire commercial trucks and solid tire trailers showed decreases of 31.11 and 8.53 respectively, being accounted for, Deems said, by the change-over from solid to pneumatic tires.

Transfers of ownership increased 14.06, going from 736,350 in 1935 to 839,857 last year.

About two-thirds of all the automobiles in the world are operating on American streets and highways, with the United States holding first rank with 26,211,052 on the basis of last year's registration. This is an average of one vehicle for every five persons. New Zealand ranks next with a ratio of one to eight; Canada, one to nine; Australia, one to 11; France, one to 20; United Kingdom, one to 23; Denmark, one to 28; Sweden, one to 39; Uruguay, one to 41; Norway, one to 46; China only one vehicle to 8,920 persons; India, one to 3,463; Turkey, one to 1,924; and Poland, one to 1,283.

Low Tolls Raise Bay Span Travel, Reduce Receipts

WHILE the number of motor vehicles using the San Francisco-Oakland Bay Bridge in February was 92,480 in excess of the January total, due to the lowering of automobile tolls, settlement of the maritime strike, and five fair-weather holidays during the month, the income of the bridge last month was $36,082.47 less than that for January, according to Director of Public Works Earl Lee Kelly.

The new 50-cent toll rate and the fact that February had but 28 days may be taken into consideration, Director Kelly said, in comparing last month's revenues with those for January.

The income for February was $348,009.80 as against $384,092.27 for January.

FREIGHT TRAFFIC GROWS

It is believed the ending of the maritime strike on February 5 accounted for an increase of 2057 trucks and 6,778,594 freight pounds. The total number of trucks using the bridge last month was 18,785 and the pounds of freight transported amounted to 41,173,165.

"A total of 667,563 vehicles crossed the bridge during February," Director Kelly said, "an increase of approximately 28 per cent over January. Had the February holidays been rainy, traffic for the month would have been considerably less. The total vehicles for January was 575,083. February traffic brought the total number of vehicles using the bridge since its opening on November 12 to 2,577,895."

Comparative figures for the months of January and February as submitted to Director Kelly by Chief Engineer C. H. Purcell are:

	Passenger Autos	*Auto Trailers*	*Motorcycles*
Total January	550,106	545	1,615
Total February	640,251	502	1,860

	Trucks	*Truck Trailers*	*Buses*
Total January	16,727	1,458	4,230
Total February	18,785	1,810	3,842

	Extra Passengers	*Total Vehicles*	*Freight Lbs.*
Total January	93,119	575,083	34,394,571
Total February	105,276	667,563	41,173,165

Central Valley Project Plans Inspire Editor

(*Editorial from San Diego Herald*)

California's vast Central Valleys Water Project, greater than the famous Boulder Canyon Dam development, is ready for construction. The bid-opening on the Contra Costa conduit, first unit of the $170,000,000 project, is less than three weeks away. The "go signal" has been flashed! The builders are ready!

Soon thousands of men will be at work on the huge, 500-mile waterway; millions of dollars in Federal funds will be pouring into California trade channels.

Just what does this giant building program mean to California business and industry? More, perhaps, than the great majority of Californians comprehend. Here are the "concrete" facts and figures—showing just what the big job will require in materials and labor:

6,528,000 cubic yards of concrete.
20,809,000 pounds of reinforcing steel.
114,543,000 pounds of structural steel.
6,496,000 barrels of cement.
5,863,000 cubic yards of rock.
3,302,000 cubic yards of sand.
38,311,000 cubic yards of excavation.
186,224,000 man-hours of labor

A stimulating prospect, that! And the story is only half told in the estimates of immediate material benefits, for the Central Valleys Project will bring permanent, lasting benefits to every section of California.

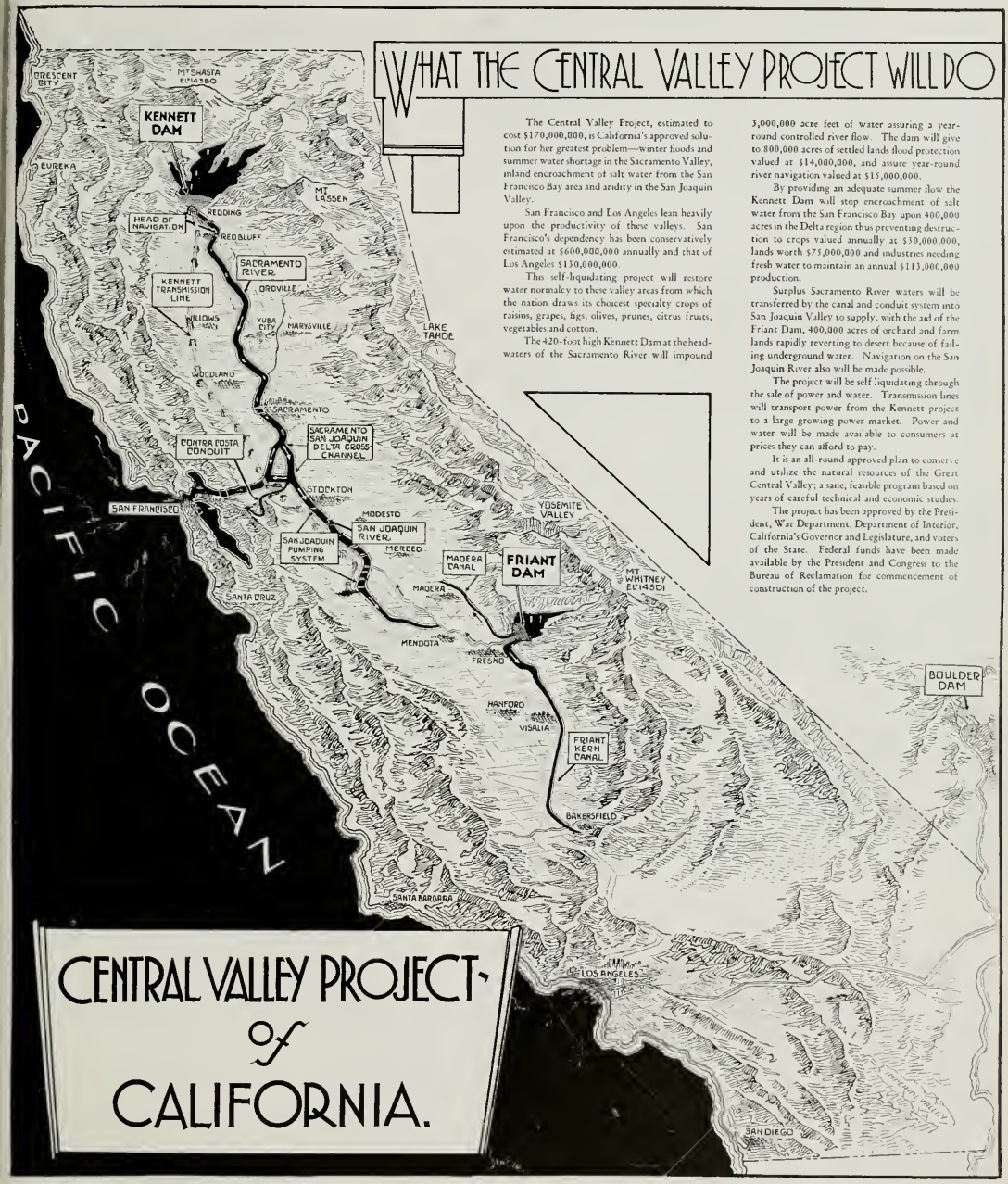
NOW, LET'S POUR CONCRETE!

Automotive Taxes Grow

Federal taxes imposed upon automotive products rose 14.2 per cent last year, reaching a total of $338,100,126, according to Bureau of Internal Revenue figures. The amount was more than $42,000,000 greater than for 1935 and set an all time high.

The major factor both in the total collected and the increase over the preceding year was the Federal gasoline tax of one cent per gallon Congress is being urged to eliminate it. This tax, enacted in 1932 as a "temporary" measure, cost motorists last year a total of $186,321,448, or 55 per cent of the total Federal automotive tax bill.

Federal gasoline tax revenues last year increased $14,057,967 over the 1935 total, accounting for about one-third of the total increase in Federal automotive taxes.


WHAT THE CENTRAL VALLEY PROJECT WILL DO
The Central Valley Project, estimated to cost $170,000,000, is California's approved solution for her greatest problem—winter floods and summer water shortage in the Sacramento Valley, inland encroachment of salt water from the San Francisco Bay area and aridity in the San Joaquin Valley.
San Francisco and Los Angeles lean heavily upon the productivity of these valleys. San Francisco's dependency has been conservatively estimated at $600,000,000 annually and that of Los Angeles $130,000,000.
This self-liquidating project will restore water normalcy to these valley areas from which the nation draws its choicest specialty crops of raisins, grapes, figs, olives, prunes, citrus fruits, vegetables and cotton.
The 420-foot high Kennett Dam at the headwaters of the Sacramento River will impound 3,000,000 acre feet of water assuring a year-round controlled river flow. The dam will give to 800,000 acres of settled lands flood protection valued at $14,000,000, and assure year-round river navigation valued at $15,000,000.
By providing an adequate summer flow the Kennett Dam will stop encroachment of salt water from the San Francisco Bay upon 400,000 acres in the Delta region thus preventing destruction to crops valued annually at $30,000,000, lands worth $75,000,000 and industries needing fresh water to maintain an annual $113,000,000 production.
Surplus Sacramento River waters will be transferred by the canal and conduit system into San Joaquin Valley to supply, with the aid of the Friant Dam, 400,000 acres of orchard and farm lands rapidly reverting to desert because of failing underground water. Navigation on the San Joaquin River also will be made possible.
The project will be self liquidating through the sale of power and water. Transmission lines will transport power from the Kennett project to a large growing power market. Power and water will be made available to consumers at prices they can afford to pay.
It is an all-round approved plan to conserve and utilize the natural resources of the Great Central Valley; a sane, feasible program based on years of careful technical and economic studies.
The project has been approved by the President, War Department, Department of Interior, California's Governor and Legislature, and voters of the State. Federal funds have been made available by the President and Congress to the Bureau of Reclamation for commencement of construction of the project.
CRESCENT CITY
MT SHASTA EL 14380
KENNETT DAM
EUREKA
REDDING
MT LASSEN
HEAD OF NAVIGATION
RED BLUFF
SACRAMENTO RIVER
KENNETT TRANSMISSION LINE
OROVILLE
WILLOWS
YUBA CITY
MARYSVILLE
LAKE TAHOE
WOODLAND
SACRAMENTO
CONTRA COSTA CONDUIT
SACRAMENTO SAN JOAQUIN DELTA CROSS CHANNEL
STOCKTON
SAN FRANCISCO
MODESTO
YOSEMITE VALLEY
SAN JOAQUIN RIVER
SAN JOAQUIN PUMPING SYSTEM
MERCED
MADERA CANAL
FRIANT DAM
MT WHITNEY EL 14501
SANTA CRUZ
MADERA
MENDOTA
FRESNO
BOULDER DAM
HANFORD
VISALIA
FRIANT KERN CANAL
BAKERSFIELD
PACIFIC OCEAN
SANTA BARBARA
LOS ANGELES
SAN DIEGO
CENTRAL VALLEY PROJECT of CALIFORNIA.



Smith River bridge, Del Norte County, built in 1907 of poor material.



Oregon Gulch timber bridge, Trinity County, not safe for legal loads.



Hayfork Creek bridge, Trinity, is old, narrow and posted.



Built in 1884, one of spans of this bridge at Red Bluff recently was knocked down by truck.



Supports under this timber truss on Yager Creek, Humboldt, wash out every year.

250 Old Bridges o Must Be Replace

By GEORGE T. McCO

COSTLY upkeep of several hundred old and unsafe highway bridges has created for the Division of Highways a very serious maintenance problem.

There are some 3280 bridges in the State road system and of these about 250 are posted as unsafe for smaller loads than those allowed by the California Motor Vehicle Code.

Approximately 1000 were not built in accordance with modern structural standards and have deteriorated to a point where constant inspections and repairs are necessary to afford safety to traffic. In other words, there are 250 highway bridges which should be replaced immediately and 1000 more which should be replaced in the near future, say in the next ten or twelve years. This makes a total of over 1200 bridges which should be rebuilt if legal loads are to be carried over these bridges in safety, and most of this work should be done in the first and not the last period of the ten to twelve years.

SEVEN MILLIONS NEEDED

The estimated cost of replacement of the bridges requiring immediate attention is approximately $7,000,000.

The estimated cost of replacements that should be made within the next ten or twelve years amounts to $25,000,000, or a total of $32,000,000.

A major bridge construction program may be the only solution of the problem.

Many of these old bridges were inherited by the State when the Legislature added 800 miles of county roads to the State system in 1931 and an additional 6800 miles in 1933. They are approaching the time when they will have to be replaced by new structures. Maintenance of them, a burden of which the counties were then relieved, is becoming more expensive each year.

OLD BRIDGES COLLAPSE

Several of these ancient structures have collapsed in recent years due to abuse from overloaded trucks, notably the Bear Creek bridge at Merced, the Santa Maria River bridge, the Kings Slough bridge in Fresno County and the Sacramento River bridge at Red Bluff.

Others are still being used as posted bridges, but the Division of Highways would be compelled to maintain a twenty-four hour watch on all of them in order effectually to prevent careless drivers from ignoring the warning signs against limited loads.

Some of these structures are used by motor buses carrying children to schools and the Division of Highways is continually faced with worry over the condition of such bridges.

State Highways Immediately

Assistant State Highway Engineer

Maintenance of all bridges on the best traversible roads along the existing State highway routings was taken over by the highway department in 1926. The length of the State system at that time was somewhat less than 6600 miles. With the additions of approximately 7600 miles and other adjustments in the system which have been made from time to time, the present mileage of the State highway system totals 13,900 miles, including highway routes through incorporated cities.

ELEVEN PER CENT POSTED

On the State system the 3280 bridges total about 469,000 lineal feet—88 miles of bridges 20 feet long and over. Of this length of bridge structure, 11 per cent are posted for limited loads.

A highway is no stronger than its weakest link, and the links are bridges. It is not the length of a weak bridge that is important but the fact that most of them impair the carrying capacity of many miles of adjacent highway. Although signs are placed at each weak structure warning the public of the reduced load limits, it has been found impossible entirely to prevent heavy loads from crossing over with attendant danger to the careless drivers ignoring the warning and other vehicles which follow.

NO FUNDS FOR SITUATION

In addition to all the posted and structurally weakened bridges above referred to, about half the remainder, or some 1000 bridges are, although structurally sound, too narrow to afford the safety to traffic which is to be expected in a highway built in accordance with modern ideas of highway construction.

From a structural standpoint alone there is found to be slightly over 2000 bridges built to modern standards, either by the State itself or by other political bodies using equivalent standards of design and construction. However, the lack of funds in past years has many times forced the use of more temporary forms of construction and the time for reconstructing some of these bridges is again approaching.

On the present State highway system will be found such structures as the old suspension bridge over the Feather River at Bidwells Bar built in 1856, the bridge over the Sacramento River at Red Bluff built in 1884 of wrought iron and a host of structures, large and small, built without competent supervision in the early years of the present century from competitive designs which sacrificed everything possible to economy.

A great number of older bridges are on poor highway alignment, or the proper location of the highway itself requires that the bridge crossing be changed.

(Continued on page 22)



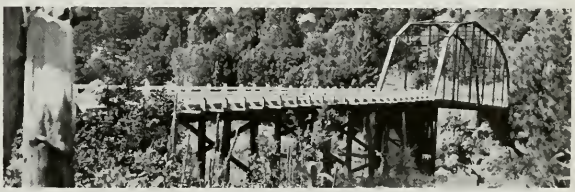
This bridge near Blairsden, Plumas, can be knocked down if hit by truck.



This 40-year old bridge over Elk Creek, Mendocino, has been cause of several severe accidents.



Dangerous structure with narrow roadway near Hopland, Mendocino.



Klamath River bridge, near Seiad, Siskiyou, could not withstand blow from truck or auto.



Type of combination truss span across Cottonwood Creek, San Diego, that is dangerous because roadway is too narrow.

"Caution" Signs Used to Show Potential Motoring Hazards

By F. M. CARTER, Assistant Maintenance Engineer

THIS is the third in a series of articles dealing with highway signs used by the Division of Highways to protect and facilitate traffic on California State highways and has to do with the "Caution" type of the warning group.

This type of the warning group is a square with two sides vertical, yellow background with black letters or symbols. In a few cases because of wording required a rectangle is used. The caution type sign is used only for conditions where there is a potential operating hazard which requires vehicles to proceed with caution. This type, however, unlike the slow type, does not necessarily require a reduction of speed.

Every caution type sign should bear a message indicating the kind of hazard. This message should always be brief and simple. A few of the potential hazards where this type of sign should be used include:

1. Highway intersections.
2. Highway construction or repairs.
3. Other temporary highway conditions.
4. Pedestrian zones.
5. Hospital zones.
6. School zones.
7. Railroad advance warnings.

SCHOOL ZONE RULES

The majority of the "Caution" signs are reflectorized for night travel. An exception to this is the school zone sign because this condition rarely presents a potential hazard after dark.

When the school grounds are not adjoining and the motorist is not able to see whether the children are at play or on their way home from the grounds, then such placement causes disregard and is a detriment to the use of these signs elsewhere.

The Vehicle Code says that the speed of any vehicle shall be fifteen miles per hour when passing a school building, or the grounds thereof, contiguous to the highway during school recess or while children are going to or leaving such school during opening or closing hours, or when the playgrounds of any such school are in use by school children.

When you see the yellow square "School Zone," watch out for children. On State highways where the road is paved this "Caution" type sign is always accompanied by pavement markings reading "School Xing."

PORTABLE SIGNS

One of the most used portable signs of this caution type is the "Men Working" sign used by highway maintenance crews to advise the motoring public to watch out for these men. In many cases these signs read "Men and Equipment Working" and it is necessary to place them at the termini of long stretches of highways to cover the movement of the equipment. Such signs are removed immediately when such work has ceased and extreme caution should be observed when such signs are in place. A red flag is always used with such signs.

Other important signs of this type are the "Slide Area" and the "Slippery When Wet." In certain sections new construction etc., slides and falling rock may encroach on the traveled way and the "Slide Area" sign which is always reflectorized advises the motorist to watch out for such slides and falling rocks on pavement.

NEED FOR CAUTION

The "Slippery When Wet" sign commands immediate caution. These signs are placed where a slippery condition may be caused by moisture on the pavement mixed with dust or when wind blows clay from adjoining cuts or area. In some cases the surface of the pavement itself presents the slippery condition when wet because of its smoothness. Such locations are resurfaced as soon as economically possible to a nonskid surface.

Many locations have conditions that border on the use of a slow type sign and then a "Slow" sign is placed in advance of the caution type sign. The caution type sign is always placed after such a slow sign to advise the motorist why he should proceed slowly.

At intersections the sign with the lowest effect and inconvenience commensurate with the hazard should be used. The development of protection of intersections is in the following order:

1. Caution type sign.
2. Slow type sign.
3. Stop sign.
4. Traffic signals.
5. Rotary traffic development.
5. Grade separations.

INTERSECTION SIGNS

The use of the "Cross Road" and "Side Road" should be restricted to intersections with roads which are improved to an extent that there is likely to be a fairly large volume of traffic entering the through highway from the side route, or where some unusual feature makes it advisable that the intersection be called to the motorists attention. The use of these signs should be limited so that they will command attention when placed. A "Cross Road" or "Side Road" sign should never be placed in advance of a "Stop" sign. The policy as to "Stop" signs and traffic signals will be discussed in a later article.

For maintenance purposes, temporary caution type signs are used temporarily to show unexpected conditions such as "Fresh Oil," etc. Such temporary signs are removed as soon as the condition is corrected.

MOTORISTS WILLING TO OBEY

Requests for new wordings on this type of sign are the most frequent. Every condition brings forth new

(Continued on page 25)

"Caution" Group of California Road Sign System



Placed 400 feet in advance of all draw bridges to permit vehicles to come to full stop if bridge is open. Traffic should slow down.



Placed at strategic points on highways where the type of pavement creates a hazard when wet.



Placed at strategic locations where hazard of slippery pavement is sufficient to warrant a reduction in speed.



Used in desert or seacoast areas where sand is blown over highway. Cautions traffic to proceed slowly.



Set 400 feet in advance of busy intersections. Used only where volume of cross traffic is sufficient to create real hazard.



Used in mountain or hilly sections where land slides or loose rocks frequently block highways. Traffic should go slowly.



This sign is placed 400 feet in advance of a side street to indicate to motorist he is approaching a side thoroughfare and should slow down.



Placed at end of area marked by a "Slide Area" sign. Traffic may resume normal speed beyond this sign.



Placed approximately 500 feet in advance of dips or depressions in highway occasionally under water. Hooded when not needed.



This sign is made with either right or left arrow. Placed in head on position to mark a sharp turn.



Placed about 400 feet in advance of all schools when school grounds are contiguous to or face highway. Maximum speed 15 miles.



Placed 400 feet in advance of side roads that end at highway and do not continue across. Used only where traffic warrants.



Placed in advance of fire stations as warning to traffic to go slowly and be on alert for fire fighting equipment



This sign is placed in advance of hospitals when the grounds of same are contiguous to the highway.



Advance warning sign for single track railroad grade crossing. Used 400 feet in advance of rails in rural areas; 200 feet in advance in cities.



Placed 400 feet in advance of intersections where slow speed is necessary to stop when pedestrians are in crosswalks.



Placed about one-half block in advance of important or heavily traveled intersections in cities. Reduced speed necessary.



Advance warning for double track (two or more) railroad grade crossing. Used in place of above sign for grade crossing having more than single track.

February Storm Damage to Highway System Totals $1,000,000

By T. H. DENNIS, Maintenance Engineer

TWO unprecedented storms during the month of February wrought damage to State highways and bridges that will cost the Division of Highways approximately $1,000,000 to repair, a sum almost equalling that expended for similar work during the entire 1935–36 winter season.

Most of the destruction occurred in the counties of San Diego, Orange, Los Angeles, Ventura and San Bernardino.

Creeks and streams that remained within their banks in the past, even during the severest of winters, and which in summer are almost dry water courses, flooded out of their beds during February and swept over highways, undermining pavements and damaging bridges.

Expenditures for removal of earth slides, replacement of fill slip-outs and emergency repair of washouts and life damage this winter will amount to about $1,300,000 and, in addition, it is necessary to replace several bridges which were totally destroyed or seriously damaged. This sum and that spent during the 1935–36 winter season represent twice the storm damage normally expected, as based on several years' previous experience.

TABULATION OF DAMAGE

The estimated total damage for the two storms—one during the week of February 6 and the second a week later—in the southern highway districts is as follows:

District	Headquarters		Amount
V	San Luis Obispo		$60,000
VI	Fresno	Roads	60,000
		Bridges	75,000
VII	Los Angeles		210,000
VIII	San Bernardino		115,000
XI	San Diego		80,000
			$600,000

For the other six districts, and including the cost of snow removal, some $300,000 was required in addition during the month of February.

This year has been peculiar to the extent that, while cost of snow removal has been heavy, only normal damage to highways has occurred in the northern part of the State, while the portion from Monterey and Tulare counties south has borne the brunt of destructive storms.

The highways in Ventura, Los Angeles and Orange counties in District VII suffered more damage than in any other section. Rainfall for the season had exceeded normal and more snow was on the ground in the Lake Arrowhead and Big Pines areas. The warm rains of February 6 and 7 caused an especially heavy run-off in the Santa Ana drainage district.

RECORD BREAKING RAINFALL

The second storm a week later, coming while the streams were still swollen with flood water and the ground saturated, resulted in immediate run-off and further flooding. The damage consisted of earth slides, earth and debris over pavement and shoulders of highways, loss of roadway and shoulder embankment and loss of stream and shore protection work. The estimated cost of repair damage in Los Angeles County alone is $210,000.

In these counties, as elsewhere, streams that heretofore had kept within their banks due to adequate bank protection work, could not carry the debris washed into them and consequently overflowed, inundating highways, undermining them and in some cases sweeping away large sections of pavement.

STREAMS OVERFLOW

In detail, the severest damage in District VII, Los Angeles, was as follows:

ROUTE 4, Weldon Canyon Cut-off and Ridge Route—20,000 cubic yards of slide material.

ROUTE 2, on the main road to San Diego—south of Tustin, a large culvert was flooded and the pavement adjacent thereto was undermined. South of Irvine, a stream paralleling the road washed out 500 feet of shoulder support, and also destroyed 1500 feet of pipe and wire protection work.

At Bear Creek, south of Galivan, the pavement was covered with water to a depth of four feet, and several feet of sand was left on the pavement and shoulders when the water receded.

North of San Clemente, at Trabuco Creek, a section of highway three hundred feet long was washed out to a depth of thirty feet, and protection work at the Trabuco Creek bridge was destroyed. Some 25,000 cubic yards of filling material, replacement of pavement, and stream protection work is necessary at this location.

DETOUR THROUGH ORANGE GROVE

As there were no parallel roads over which traffic could be detoured, it was necessary to secure permission to pass light traffic through the adjoining orange grove over a plank road constructed for the purpose. Truck traffic was routed to Newport, thence south to Dana Point and San Diego.

ROUTE 60, at San Juan Creek, about sixty feet of three-lane pavement, as well as about seventy-five feet of the pile wing wall and the entire road embankment, was washed out to a depth of thirty feet.

ROUTE 64, two and one-half miles east of San Juan Capistrano, two hundred feet of the west approach fill to San Juan Creek bridge was washed out. The road was also closed by slides in the mountain section to the east. West of Santa Monica, the road was closed for several hours by some 25,000 cubic yards of slides.

HEAVY SLIDES

The Laguna Canyon road was damaged by high water, and heavy slides occurred in San Gabriel Can-



San Mateo Creek becomes miniature Niagara 20 miles north of Oceanside, San Diego County, and washes away highway pavement and shoulders.

yon, as well as Decker and Grimes Canyon routes.

ROUTE 43, through Santa Ana Canyon—some $10,000 is required to clean debris from pavement, to replace lost embankment, and to repair the fence and brush type of protection work.

ROUTE 79, in Ventura County—some $4,000 is required to clean debris from pavement.

ROUTE 138, Ventura to Maricopa highway. This road was closed by 50,000 cubic yards of slide material. The estimated cost of slide removal and clearing out the drainage system is $30,000.

ROUTE 2, in Ventura County—the sum of $9,000 is estimated cost of cleaning mud from pavement and cleaning drainage ditches, etc.

DISTRICT VIII HARD HIT

Rainfall in San Bernardino and Riverside counties broke all records in February, resulting in damage in District VIII amounting to $115,000.

In San Bernardino a total of 25.50 inches of rain had fallen, and 8.64 inches was added in February when the heaviest storms occurred on February 6th and February 14th.

With the Coast Highway to San Diego closed and the Santa Fe Railroad service to San Diego tied up, the only route open to traffic between Los Angeles and San Diego was by the inland route through Riverside, Elsinore and Fallbrook. Highway crews struggled night and day to keep this important traffic, as well as traffic between Los Angeles and Imperial Valley, moving without serious interruption.

The Santa Ana Canyon route leading from the west end of Riverside County into Orange County was closed for two days following the February 6 storm and for several hours following the February 14 storm. This condition was caused by the Santa Ana River overflowing and inundating the highway to a depth of approximately three feet. Portions of the highway along the river bank were partly washed away.

The Ortega Highway leading from Elsinore to San Juan Capistrano was closed by numerous slides and probably will remain closed for thirty days.

The Imperial Highway between Temecula and Warner Hot Springs was closed for seven days as a result of one of the pile bents in the Temecula River bridge being washed away.

The Pines-to-Palms Highway leading from Hemet through the San Jacinto mountains to the Coachella Valley was closed by numerous washouts where the San Jacinto River parallels the highway. Three bridge approaches were also washed out on this route, necessitating many thousands of yards of backfill. The probable period of closure on this route will be thirty days.

DEBRIS FILLED STREAMS

The foothill road between the Moreno and Hemet valleys suffered considerable damage when the San Jacinto River flowed beyond the capacity of its channel and due to great deposits of silt and gravel washed upon this highway from Massacre Canyon, the loss of a portion of the south approach to the San Jacinto River bridge necessitated considerable backfilling. This route was closed to traffic for two days.

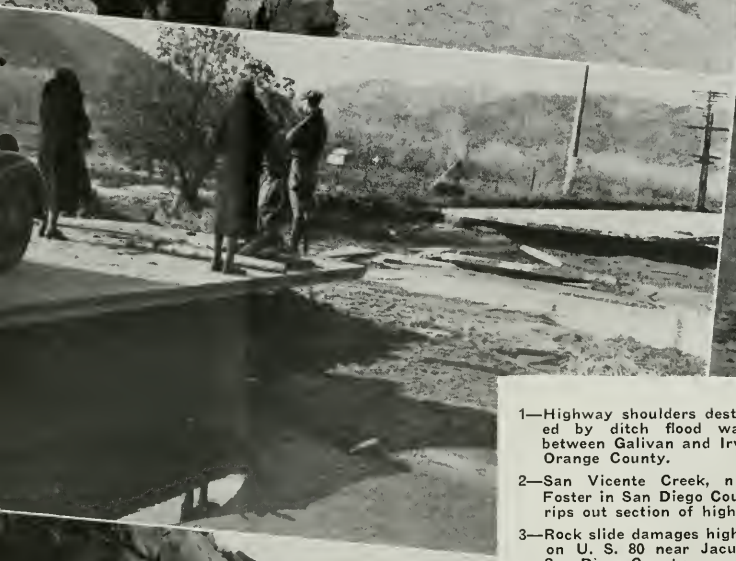
The new Jack Rabbit Trail between Riverside and Beaumont was closed for one week by many slides. While the road was opened after about seven days of work it will be some time yet before all of the slides are removed.

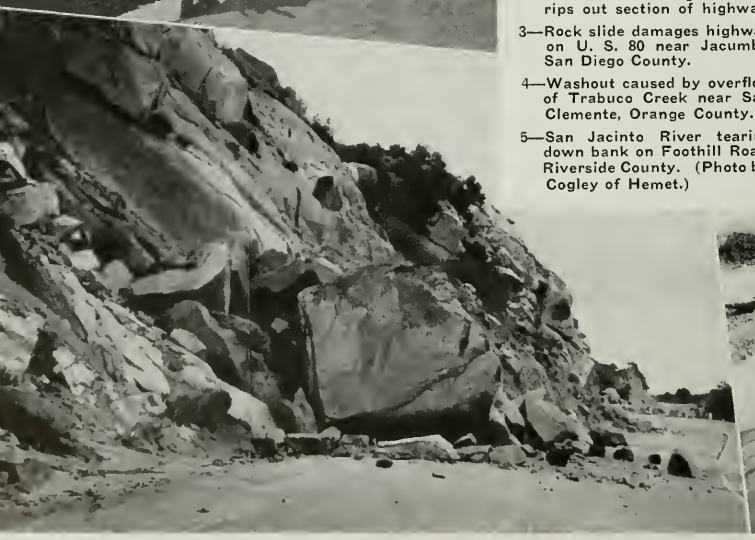
The highway from San Bernardino to Imperial Valley was closed for a few hours during each of the heavy storms where the highway is crossed

(Continued on page 16)

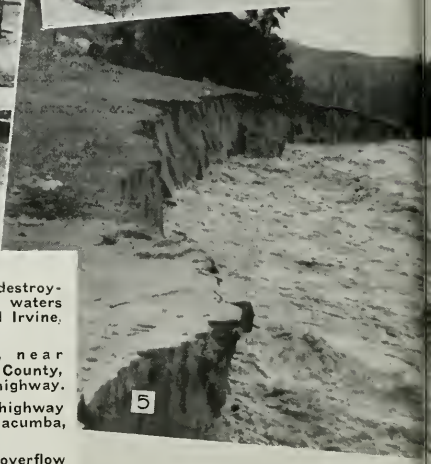
Scenes of Flood Damage to State Highwa

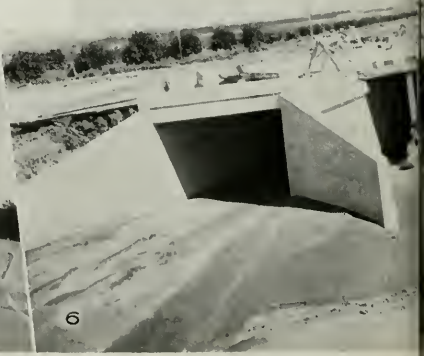












1—Highway shoulders destroyed by ditch flood waters between Galivan and Irvine, Orange County.

2—San Vicente Creek, near Foster in San Diego County, rips out section of highway.

3—Rock slide damages highway on U. S. 80 near Jacumba, San Diego County.

4—Washout caused by overflow of Trabuco Creek near San Clemente, Orange County.

5—San Jacinto River tearing down bank on Foothill Road, Riverside County. (Photo by Cogley of Hemet.)

During Abnormal Rain Storms in February





6—Undermined pavement at culvert east of Tustin in Orange Caunty.

7—Flood waters on secondary road between San Diego and Jacumba, San Diego County.

8—All that was left of highway bridge on Route 60 near Dana Point, Orange County.

9—San Juan Creek destroys 300 feet of bridge approach near San Juan Capistrano.







February Storm Damage to Highway System Totals $1,000,000

(Continued from page 13)

by the Owl Wash on the desert below Banning.

BRIDGE IS SAVED

The Owl Wash is a very elusive stream which meanders around over a debris cone above the highway and very often crosses the highway at points other than where the concrete bridge is located. Great deposits of gravel and boulders were left on the west approach to the bridge. State Highway equipment was stationed at this bridge for the purpose of towing traffic through the water and debris.

Where this route crosses the Santa Ana River two miles south of San Bernardino, washing of the river into the north approach caused serious concern. A shipment of piling and bulkhead timbers were secured from the coast and a bulkhead 200 feet in length hurriedly constructed to protect the approach fill against subsequent storms. Due to strikes no timber in excess of two inches in thickness was available in any of the Southern California timber yards. Timbers were eventually located in the Santa Fe yards at National City and were hurriedly transported to the bridge site by truck.

The Palm Springs Highway between Whitewater and Indio was closed below Palm Springs for a period of several days due to the loss of two miles of pavement when Palm Canyon Wash went on a rampage. Telegraphic permission was secured from Washington, D. C., to route State Highway traffic for a period of sixty days over an old road crossing the Indian Reservation. It is possible to reconstruct the two miles of pavement in its old location.

MANY LAND SLIDES

The Barton Flats Highway leading from Redlands into the San Bernardino mountains was seriously damaged by many slides. At this writing it was not possible to determine the amount of material on the highway as most of the earth slides are covered by snow. Some of the large fills are seriously damaged where culverts were insufficient in size to carry the entire flow of the streams. This road may be closed for a total of sixty days.

The Crest Drive to Lake Arrowhead and Big Bear Lake resorts was open practically at all times except at Dry Creek where a bridge approach was washed away. Here the road was closed for a period of two days. This route, however, has many slides which must be removed during the next thirty days.

The desert routes on the Mohave desert experienced practically no damage.

At the time the first heavy February storm took place, four power shovels were at work in District VII on slides resulting from previous storms of lesser intensity. Eight additional shovels have now been employed and are at work removing slides and repairing washed out fills and bridge approaches.

UNUSUAL RAINS

A review of conditions in San Diego and Imperial counties in District XI where a rainfall of 9.03 inches in a 12-hour interval was recorded, of which the greater portion fell within two or three hours, reveals that damage to State, county and city highways was extensive.

Damage in San Diego County to the State Highway System has been estimated at $80,000. This storm wrecked one forty-five foot timber bridge, and washed out six bridge approaches, some of them on the main coast highway.

PAVEMENT UNDERMINED

Several sections of pavement were undermined to such an extent that they required replacing. All culverts and dips ran full and several washed out, including one large concrete dip and one rubble masonry overflow dip. Practically all roads were at least partially blocked by slides, mostly rocks. Rocks, some of them ten feet through, slipped onto the highway in many places.

Maintenance crews were on the job continually, and patrolmen were out all night. By 10 p.m., February 6, nearly every truck in the Maintenance Department was out, pulling motorists from dips, placing barricades and lanterns to warn the public of washouts and slides, and trying to keep drainage structures open. The first indication of serious trouble came about midnight when reports came in simultaneously in that the approaches to one bridge on the Coast Highway, U. S. 101, and another on U. S. 395, near San Diego, were washing out.

PATROLS ON JOB

One crew arrived just as the pavement slab at the Sorrento Bridge fell after a car had passed over, and narrowly averted a serious accident by getting lights and barricades up before the next motorist arrived. Fortunately the patrols were able to place warning lights in sufficient time to avoid serious accidents, at several places. Several hundred motorists were towed from dips.

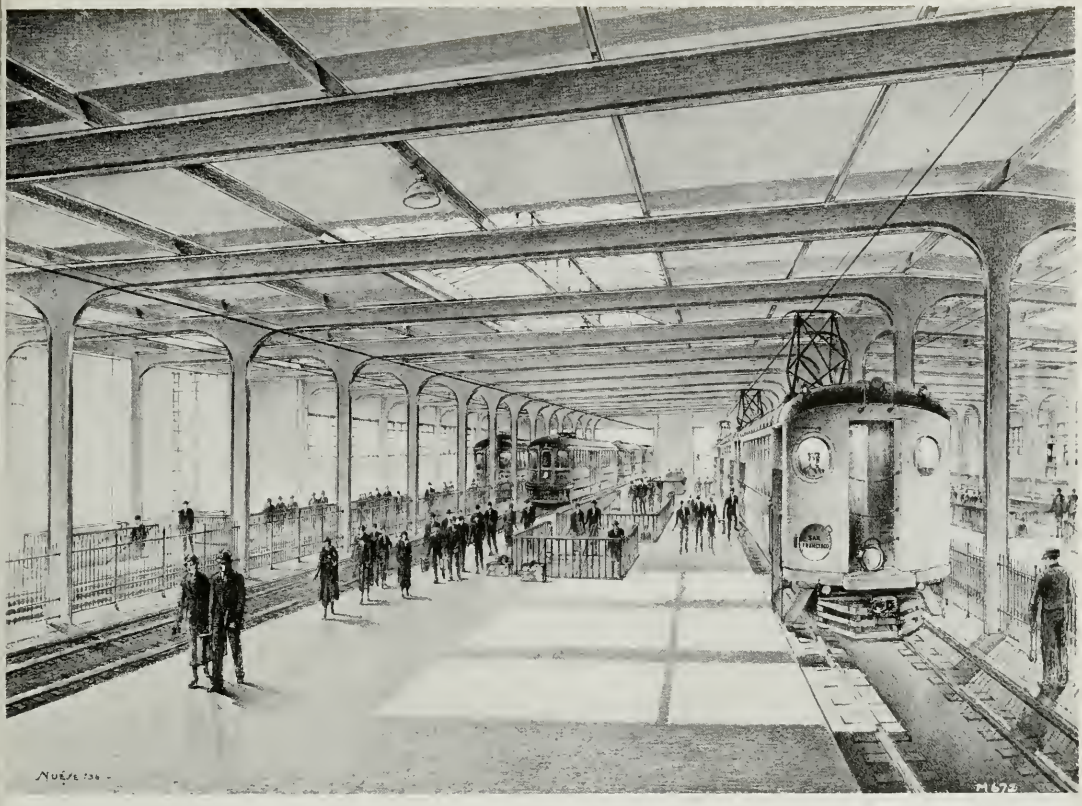
Immediate steps were taken to open the main highways. At the Sorrento Creek Bridge, where thirty feet of the north approach was washed out at approximately midnight, replacement was in progress by 6 a.m. Rock rip-rap was taken from adjacent sea walls to check the water, and thirty-eight hours after the washout the first traffic was allowed to cross. During this time another approach partially washed out on the route over which the fill material was being hauled, and by prompt action a second break was checked.

The highway maintenance crews worked long hours, and many of the foremen and others worked continually through two days and one night. Contractors on State Highway projects were of great assistance in furnishing equipment and crews to the Maintenance Department, and it was through their cooperation that traffic was reestablished promptly in several instances.

SAN JUAN BRIDGE LOST

In District V, with the exception of the loss of the bridge across the San Juan River west of Simmler, on Route 58, the main damage in Monterey, San Luis Obispo, and Santa Barbara counties was due to slides. It is estimated that it will be necessary to move some 150,000 cubic yards of material to replace the roads in their original conditions. Route 57—the Cuyama lateral—with some 24,000 cubic yards, Route 56—along the coast—with nearly 60,000 cubic yards, and

(Continued on page 27)



Interurban Train Platforms for San Francisco Terminal of Bay Bridge

INSTALLATION of interurban facilities on the San Francisco-Oakland Bay Bridge is expected to be completed by the summer of 1938, according to Chief Engineer Charles H. Purcell.

Work on the construction of the San Francisco Interurban Terminal, the design of which is shown in the accompanying architect's drawing, is now under way.

All tracks and loading platforms in the terminal will be entirely roofed for a length of 700 feet, with large skylights and windows providing ample lighting.

Because the Bay Bridge trains will arrive at the terminal every minute during the rush hours, the present congestion caused by the 35,000,000 annual commuter traffic between the East Bay and San Francisco is expected to be eliminated by the more uniform distribution of passengers.

Plans call for six tracks arranged in pairs with platforms between alternate trains, with an over-all station width of 164 feet. Two inner platforms will each be 27 feet in width and two outer platforms will each have a width of 14 feet. Fences between the pairs of tracks will prevent passengers from crossing them, to their danger.

Each platform will have a system of 7 ramps or stair connections to the mezzanine concourses, from which commuters will leave the terminal building.

The ramps and stairways will be spaced along the entire length of the loading platform so as to serve an entire train and to give passengers a minimum walking distance.

Safety Enforced by Bridge Squad

A total of 1241 cars were stopped and their drivers warned during the month of February on the San Francisco-Oakland Bay Bridge; while 99 arrests were made for various violations, according to a report submitted by Captain Rudy Schmoke, head of the Bay Bridge Detail, to Raymond E. Cato, Chief of the California Highway Patrol, in a campaign to make the bridge not only "the finest but the safest highway in the world."

Teacher: "Where is the capital of the United States?"

"All over the world."

States Not Ready for Divided Highways Because of High Cost

By MURRAY D. VAN WAGONER, Highway Commissioner of Michigan

Taking as his subject, "Are the States Ready to Assume the Economic Problems Involved in Starting a Program for Divided Highways?" Highway Commissioner Murray D. Van Wagoner of Michigan answered the question with an emphatic "no" in an address he delivered before the Administrative Problems Group of the convention of American Association of State Highway Officials in San Francisco. His discussion of the topic, in part, follows:

SEVERAL months ago a great national magazine, in an article on "Foolproof Roads," put us highway commissioners on what we gently refer to as the well-known "spot." The American people were told that fifteen billion dollars had been invested in their road system but that the road builders had fumbled the ball. We were taken to task for using paint in the middle of the road, for widening our two-lane highways to three lanes, and for other efforts we have made in the interest of public safety and orderly traffic.

Since the appearance of that article, there have been others but I have not yet noticed any in defense of highway administrators. Subsequent literary output relating to the same general subject material has taken on a very humble, apologetic aspect.

While I realize that I can not speak for the American Association of State Highway Officials, I would suggest that we need to make no apology to the motoring public of America on our stewardship as administrators of the greatest highway system in all the world. This attitude does not blind itself to the reality that this system is far from perfect and that there is need for more and better highways and highway structures. But it is an attitude that says to the motoring public that it has fared well for all the obstacles it has thrown into our pathway either directly or through its chosen legislative representatives.

For all the space that was taken in this article to chastise the State highway officials of the 48 States, I would emphasize that the conditions it cited were those prevailing largely within the corporate limits of our great industrial centers. It is significant that, until three years ago, we as State highway officials were powerless to remedy traffic congestion in these cities through new construction on our several Federal Aid programs. It is just as significant, at least in Michigan, that the greatest advance that has been made in correcting such conditions has been registered since we were permitted to do something about the matter.

Doubtful if Needed

"All this evidence leads to the unalterable conclusion that the States are not yet ready to assume the economic problems involved in starting a program for divided highways. It is doubtful that such a program is even needed in most of our States. In most of the others, it appears that State highway authorities do not have sufficient control over highway revenues to meet the enormous costs of this type of a program.

"At the same time, I am not so pessimistic that I think the day will never come when such a program will be possible. It is my opinion that we State highway authorities, in future planning, should make provisions for such a program by insisting upon adequate design and adequate right of way. This is particularly true with regard to the design and construction of new highways."

DIVIDED HIGHWAYS DEMANDED

But it is not for me to launch into a lengthy discourse as to the efforts to which we State highway officials have gone to build safety into our highways and highway structures. I am here to talk to you about the economic feasibility of instituting a nation-wide, divided highway program.

The demand back of the divided highway of course is the demand for greater safety on our highways. The theory of the divided highway is that it eliminates or reduces merical friction. In less technical language, it forces drivers to stay apart from each other even though they haven't the sense to do it voluntarily.

Now we will all admit that the divided highway is a noble public safety objective. At this time, it appears to be the ultimate in highway safety, at least to so many States whose revenues are so restricted that they are lucky to build hard-surfaced roads, much less superhighways that are divided.

However, there appears to be some exaggeration as to what the divided highway can accomplish in highway safety. Special studies made by the Michigan highway planning survey on divided and undivided highways bear out this common exaggeration. Let me cite, as a typical trunkline embraced in these studies, records on US-112 between the cities of Wayne and Ypsilanti, Michigan.

SURPRISING STATISTICS

The figures cover accidents between these two cities on this trunkline for the first six months of 1936. From the west city limits of Wayne to the Wayne County-Washtenaw County

line, a distance of 8.86 miles, the trunkline is a four-lane divided highway. From the county line to the east limits of Ypsilanti, a distance of 2.97 miles, the highway is a four-lane, undivided road.

The records show that there were 24 accidents the first six months on the divided highway and 12 accidents on the undivided highway. Inasmuch as the mileage was different, we reduced the accident rate to terms of million vehicle miles.

We find that there was an average of 2.18 accidents per million vehicle miles on the four-lane divided highway for the first six months of the year and an average of 3 accidents per million vehicle miles on the four-lane undivided highway for the same period. In other words, dividing the highway meant a reduction of only 82 100 in the accident rate per million vehicle miles.

MORE SURPRISING FIGURES

The injury and death rate comparisons are even more surprising. On the divided highway we found an injury rate of 2.36 persons per million vehicle miles whereas on the undivided section the rate dropped to 1 person per million vehicle miles. There were no deaths recorded on the undivided section while the death rate on the divided trunkline was 18 100 per million vehicle miles.

This trunkline, as I have explained, was not singled out with any desire on our part to obtain a prearranged conclusion but is typical of several included in the highway planning survey studies. The trunkline in this area is not the heaviest-traveled artery in the State but is among the heaviest traveled. The estimated yearly traffic density ranges from 2,400,000 to 4,000,000 vehicles on the trunkline between these two Michigan points, depending on the particular section under observation.

The report did show that there were five head-on collisions on the undivided section of the highway while no such accidents were reported on the divided section. The head-on collision commonly rates next to the grade crossing accident as the most serious yet there were no deaths on the undivided section and a death rate of 18 100 per million vehicle miles on the divided section. Perhaps we are to draw the conclusion that drivers will find a way to injure and kill themselves even if we remove the possibility of head-on collisions.

NOT A CURE-ALL

This study on Michigan trunkline US-112 gives proof that the divided highway does reduce the accident rate but it does not offer sufficient proof for us to regard this type of development as a cure-all for the accident problem. I would emphasize that all surveys have shown that the human factor is still the greatest factor in highway accidents. All the divided highways in the world will not eliminate this controlling factor.

Now we come to a consideration of the costs of constructing divided highways. Here the controlling factor is the amount of money needed to purchase additional right of way.

Before detailing some of our experiences with right of way costs in Michigan, it is well to state my belief that any divided highway program should presuppose the necessity for adequate right of way. In my opinion, the 3 or 4-foot safety island does not answer the problem of divided highways but rather increases it.

The narrow safety island gives no protection to the motorist at intersections whatever. A motorist intent upon crossing the highway at an intersection will depend upon the island for protection from automobiles rushing at him from his right or left. But how can the island offer him any protection when it does not even cover the length of his automobile?

COST IS HEAVY

We all know that any method of separating highways with a strip of land involves certain engineering problems such as adequate drainage. These problems mean heavy expenditures. As long as we must meet these basic problems under any plan of divided highways, it is my contention that we should do the job right. In other words, give the motorist a parkway that will protect him at intersections as well as along other sections of the highway. If we are to do the job, let us have adequate right of way and adequate design.

It is fundamental in an economic discussion of the problem that divided highways are justified only along highway sections of heavy traffic density. These sections are generally found either inside our great industrial centers or within the immediate vicinity of these metropolitan areas. It is in such areas that right of way costs are the highest.

It has been our experience in Michigan with approximately 80 miles of divided highways on the state trunkline system that this type of construction will cost from $100,000 to $600,000 a mile. In one instance, at least, these costs in my state have been considerably higher. I refer to Woodward Avenue in the city of Detroit, which, as US-10, has been characterized by one of our leading engineering publications as the most magnificent trunkline entrance into an American city.

EXPENSIVE IMPROVEMENT

Three years ago the State Highway Department started out to restore Woodward Avenue to the 120-foot width originally planned for it by the pioneers of Detroit. We have just completed that job, a 2½-mile project that cost in the neighborhood of $14,000,000. Today Greater Woodward Avenue for 2½ miles starting at Grand Circus Park has a 90-foot roadway of concrete base and sheet asphalt surfacing, 7½-foot brick-surfaced parking areas, and 15-foot sidewalks.

Today Woodward Avenue has a minimum 120-foot right of way all the way from Detroit to Pontiac, 25 miles distant, with the exception of a short section through the city of Birmingham. Outside of Detroit and Highland Park this highway becomes a divided road with the center parkway varying from 40 to 70 feet in width. Here the right of way branches out to 204 feet.

Right of way costs on the 2½-mile area of Woodward Avenue within the city of Detroit approximated $10,000,000 alone. Property condemned by the court for the widening included some of the most valuable real estate holdings in the entire city.

It is granted that the right of way costs on Woodward Avenue were the exception rather than the rule in their enormous amount. But I have explained that right of way is the controlling factor in making the cost of divided highway construction in Michigan range from $100,000 to $600,000 a mile. Compare this cost then, with the average of $75,000 to $80,000 a mile required for simple four-lane, undivided widening construction.

Let us see if it is economically feasible for the States to initiate a divided highway program. In the prepara-

(Continued on page 22)

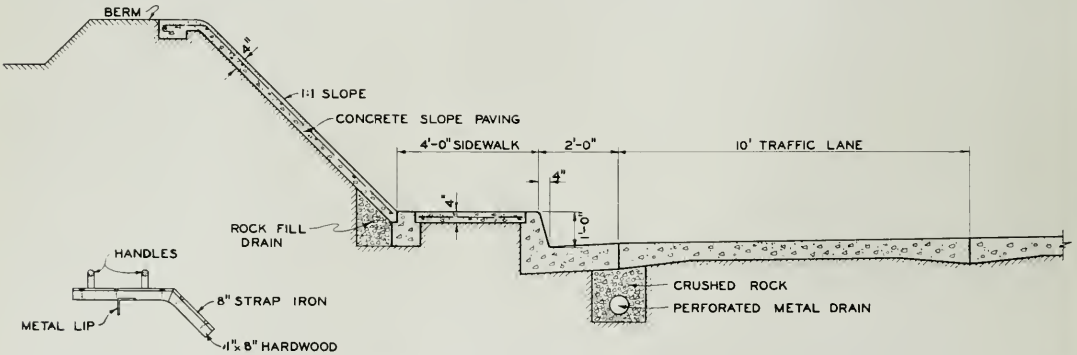
Improved Drainage Designs Used On 41 Grade Crossing Projects

By HARVEY D. STOVER, Bridge Designing Engineer

DURING the present biennium, the Division of Highways has constructed 41 different grade crossing projects in California for which the Federal Government appropriated $7,318,141 in pursuance of its Works Progress program.

An important feature of any grade crossing undertaking is the provision of adequate drainage and control of ground water and runoff.

Improved designs for drainage construction have been followed by the Division of Highway engineers in the extensive grade separation program it has carried out.



SUGGESTED FINISHING TOOL

SECTION THROUGH DEPRESSED PORTION OF UNDERPASS

In level areas where highway and railroad approach and intersect at approximately the same elevation it is usual practice to depress the highway on light grades and pass under the railroad. The drainage area involved is considerable and provision must be made against possible flooding from any cause.

When ground water is present and roadway is protected by reinforced concrete sidewalls and concrete pavement thickened to withstand the hydrostatic pressure. Walls and pavement are surrounded by a membrane waterproofing seal. Additional protection at expansion joints is provided by flexible strips of copper cast into the concrete.

Side slope drainage, runoff and seepage, is intercepted by perforated metal drains located in ditches along the bottom of the slopes. The bottom of the ditch is covered with a six-inch layer of gravel, the drain is placed and the ditch is then completely filled with gravel ranging in size from one to three inches. Drains lead to drain boxes at the bottom of the depressed roadway.

Pavement runoff is intercepted by catch basins placed at intervals along the curbs at both sides of the roadway, and carried through pipes to the drain boxes.

Drainage water is carried through pipes from the drain boxes to the sump from which it is disposed of by pumping into the nearest available natural drainage channel or storm sewer. The sump pumps are usually installed in pairs and are of the submerged vertical centrifugal type driven by electric motors. The operation is automatically controlled by float switches.

Pump capacities vary according to the drainage area and amount of rainfall anticipated. In localities where short periods of very heavy rainfall occur at intervals it is more economical to provide storage than to install large capacity pumps. A concrete reservoir connecting with the sump is constructed under the roadway to store the heavy runoff. Normal size pumps can then empty the reservoir after the peak runoff has subsided.

The section through the depressed portion of underpass as illustrated is typical of many of the Division of Highways designs. Where sandy material is encountered that erodes easily, it is the general practice to slope pave the cuts on one to one (1:1) slope; however, where the material encountered has stability, the side slope is made on one and one-half to one ($1\frac{1}{2}$:1) slopes and the slope paving is omitted.

The perforated metal drains at the sides of the paving are necessary only when considerable ground water is encountered, in which case it intercepts the water and makes it possible to maintain dry subsoil under the paving. Additional drain at center of paving has been found necessary in some locations.



Two views showing close-up and approach to recently completed Famosa grade separation project in Kern County involving a bridge over Poso Creek, a cattle pass, a bridge over Lerdo Canal and subway beneath railroad. Pumps and storage space assure subway will be kept dry.

Subway at Famosa Eliminates Grade Crossing Problem

WITH the opening to traffic on January 28, of the new subway at Famosa, in Kern County, another dangerous grade crossing has been eliminated on the State highway valley route between north and south.

The former highway crossed the tracks of the Southern Pacific Railway about one mile north of Famosa. The new alignment brings the highway 700 feet west of the tracks for a distance of about half a mile from the subway, and involves four structures, a bridge across Poso Creek, a cattle pass, a bridge over the Lerdo Canal, and finally the subway proper, under the Southern Pacific tracks. In the last named structure, steel plate girders carry two tracks over a clear roadway width of 44 feet on a 35 degree skew. No center pier is used.

Special precautions have been taken to see that the subway will be kept dry. In addition to the two pumps, each capable of lifting 800 gallons per minute through a 35 foot head, water storage space has been secured under the pavement with a capacity of 120,000 gallons, to give ample safety factor for the pumps to handle water at times of extreme rainfall.

The Griffith Company of Los Angeles was the general contractor for the work.

Cub Reporter: "I'd like some advice, please, on how to run a newspaper."

Editor: "You've come to the wrong person, son. Ask one of my subscribers."

"Waiter here's a half a buck for you."

"Yes, sir. Do you want to reserve a table?"

"No. When I bring my girl friend in here tonight, tell us they're all reserved."

250 Old Bridges on State Highways Must Be Replaced Immediately

(Continued from page 9)

New highways or highway connections are continually being built which require the building of new bridges. A study of State highway bridges constructed since June, 1927, shows that less than 40 per cent of the money allocated for bridges and grade separations has been used to replace bridges that were structurally weak.

The expenditure of no greater funds than have been spent annually for bridges in the past would do all the necessary bridge replacement outlined above, provided they can be spread out over several years more. Each year will see a larger number of bridges added to those which have to be posted for reduced load limits.

MAINTENANCE COST HIGH

The effort to carry on with the highway bridges in their present condition is constantly increasing the cost of maintenance. Uneconomical betterments and widening of roadway are making bridges safe for increased loadings so they can serve a few years more until money for their reconstruction, or for the reconstruction of the adjacent highway, can be obtained. With all this work goes the continuance of the risk of serious accidents — accidents of usually a much more serious nature, and productive of much more publicity than those occurring elsewhere on the highway.

Existing traffic conditions make it impossible to postpone the present progress in the reconstruction of highway bridges, and, if the cost to the public over several years and the responsibility for the safety of those crossing the bridges is given proper consideration, the expenditure for this purpose must be materially increased during the next few years.

Old, weak and otherwise unsatisfactory bridges are being replaced and repaired as rapidly as money is available but funds are insufficient to adequately take care of the situation. Many more than the 250 bridges now posted for restricted loads should be posted on general principles, inasmuch as they are potential hazards even though they can normally carry legal limit loads.

This refers to bridges which are of such construction that they could be struck and wrecked by trucks and automobiles. They may be of such narrow width that accidents would be caused by two cars attempting to pass each other.

DANGER TO SCHOOL BUSES

Many of these posted bridges are on primary highways and by their reduced load limits work a hardship on the transportation of farm produce, manufacturing and the trucking organizations. This is also a more serious situation when one considers the large school buses now used on practically all of the highways and which carry a large number of students.

Almost any day one may see articles in the papers outlining accidents in which autos colliding with narrow bridges have caused the death or injury of the occupants.

One recent article told of the collapse of such a bridge when a structural member was struck by a light passenger car. That bridge had been posted for a restricted load limit and the warning had been ignored. The passage of a heavier load had weakened the whole structure almost to the point of collapse and the impact of the lighter car caused the structure to fall. Such a failure of posted structures is a constant hazard.

The bridge situation on the State highway system is consequently so serious as to require that sober thought and consideration be given to the expenditure of a large sum of money to permit the carrying of legal loads over all our bridges, and prevent fatalities which might be caused by inadequate highway structures.

"Say, pop, did you go to Sunday school when you were a little boy?"

"Yes, son, regularly."

"I'll bet it won't do me any good, either."

"Are you a fellow who is bothered with flat feet?"

"Am I? I've been arrested by just one flatfoot after another."

States Not Ready for Divided Highways Because of High Cost

(Continued from page 19)

tion of this paper, I sent questionnaires to the various state highway authorities on this subject. Only 8 out of 29 reporting States have any divided highway mileage at all on their trunkline systems while 3 others have made definite plans for this type of construction on a limited scale in the future.

Most of the States reported the traffic density on existing roads did not warrant a divided highway program.

DIVERSION SERIOUS MATTER

While the American Association of State Highway Officials seriously deliberates the expensive problem of divided highways, the greatest danger to road-building that has ever faced us, continues at a merry pace. In 1935 the diversion of highway revenues for nonhighway purposes increased by $24,000,000 and reached the unprecedented level of $200,000,000—enough to build a 20-foot, hard-surfaced highway all the way from this city to New York City.

While the actual diversion of highway revenues for nonhighway purposes in my own State is negligible, we have the peculiar situation of a legislature having appropriated more highway money than is actually taken in. If the Michigan State Highway Department fully met all of its statutory obligations it would not have enough money to operate. Three-fifths of all our revenue is returned directly to the counties and the balance is obligated by other fixed, statutory requirements.

In view of the way in which highway revenues have been treated as a grab bag for every scheme of relief and tax reduction, it is a wonder that the State highway authorities of our country have come as far as they have in building the greatest highway system in the world.

A backwoods woman, the soles of whose feet had been toughened by a lifetime of shoelessness, was standing in front of her cabin fireplace one day when her husband addressed her.

"You'd better move your foot a mite, maw; you're standing on a live coal."

Said she, nonchalantly: "Which foot, paw?"



Expert Aid in Accident

Mr. Lester H. Gibson, District Engineer,
California Division of Highways,
San Luis Obispo.

Dear Mr. Gibson:

Recently I was an eye-witness to an accident which occurred about half-way between the top of Nojoqui Grade and Las Cruces Store on Route No. 101.

It is not my purpose to go into a discussion of the accident and its causes, but briefly to tell of the handling of the situation that arose by members of a State Highway crew that was working close by.

When a truck turned over, spilling its load of household goods over the highway, a flagman who was at hand took immediate charge. I being the first motorist to arrive, he gave me the job of helping the people out and taking care of some six persons ranging from seven to eighteen or twenty years of age. The second motorist arriving, he instructed to proceed towards Las Cruces and notify his Section Foreman to come up; the third motorist he stopped and instructed to prevent anyone coming near the truck's gasoline tank, to forestall any possibility of the gasoline becoming ignited and setting the truck on fire. In addition, he was routing traffic through both ways (the upset truck occupied not only one shoulder, but half the width of the pavement), allowing no one to park. * * *

Within five minutes of the time he sent for aid from his crew foreman, the latter arrived, followed by two men comprising a grader crew. This foreman took charge; inside of ten minutes he had a man and woman, who were caught in the cab, extricated; he had a mattress from the load spread out for the man who had been driving, and had determined that the only injury was a broken arm; had gathered the groceries and household goods off the roadway, and also the loose poultry. He then requested me to go on down to Las Cruces, notify the State Highway Patrol to send out an ambulance and officers.

I don't suppose it took him—from the time the accident happened—over thirty minutes to accomplish all of the above and have me on the way to telephone. The purpose of this letter is to express my admiration of the leadership displayed by the flagman and section foreman, whose names are unknown to me—for the way they handled this whole affair. You might say they took it "in their stride," as if such things were merely a part of the daily routine. Our State is to be complimented on the calibre of the men in its Highway Department. To me it was a revelation to see first-hand, how these men went into action without a wasted word or movement.

Sincerely yours,

(Signed) P. E. P. BRINE,
Santa Barbara, California.

Planning in Capable Hands

Gentlemen:

I would appreciate considerably your adding my name to your list of subscribers to your monthly publication.

I recently had an opportunity of looking over the last two copies and found them not only extremely interesting but highly instructive, and I was gratified to realize that our highway planning and maintenance is in such capable hands. Furthermore that there seems to be more interest taken in beautifying the landscape and banishing signboards.

Respectfully yours,

G. S. WORRELL.

Marvel of Improvement

Mr. S. V. Cortelyou, District Engineer,
Los Angeles, California.

Dear Mr. Cortelyou:

Because of the wonderfully improved condition of the road at McKevett crossing I am impelled to write you a word of praise for the success achieved in changing a terribly bad condition at this point to one of perfect delight to the traveler.

We, of course, are pleased with the new curve west of Saticoy and know we shall like the two new bridges being constructed on our highway but the job at McKevett crossing is such a marvel in improvement as to deserve special comment. We fully appreciate your accomplishment in this piece of work and would have you know that this is the whole-hearted expression of our people.

Respectfully yours,

M. H. BUTCHER,
Santa Paula, California.

Teaching Safety

Division of Highways,
Sacramento, California.

Dear Sir:

Please enter my subscription to your departmental publication entitled California Highways and Public Works. I wish to use it in my classes to teach SAFETY.

Sincerely,

ARTHUR E. LINDBORG,
Oakland, California.

Thanks from Observatory

Lick Observatory,
University of California,
Mount Hamilton, California.

L. T. Robinson,
Maintenance Superintendent,
State Highway,
San Jose.

My Dear Mr. Robinson:

During the past year you converted the dirt road between San Jose and here into a pavement that meets every reasonable demand of the traffic it is called upon to bear. The road is perhaps the most important factor determining the comfort of the people of this community. One can now, for the first time since the Observatory was established, count on making a clean, comfortable and safe trip to San Jose, and I think that none of us avails himself of that privilege without thought of the Division of State Highways, and of the men who have made such travel possible.

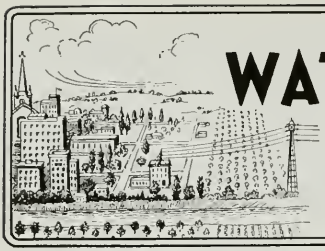
I wish further to say that to the best of my knowledge, every contact of our people with you and your men has been marked by the utmost friendliness and courtesy.

I may add that the enforced delay in writing permits me to thank you for your service to the Observatory during the exceptionally severe weather since January 1. At considerable effort you have kept the road free from snow, and the upper part has been put under control, to the advantage and safety both of the general public and of the residents of Mount Hamilton.

While it was my original intention to make this a personal letter, several members of the staff have suggested that I write you in expression of our common appreciation of the quiet, courteous and effective way in which you and your men have gone about your work. I therefore request that you regard this as a somewhat belated holiday letter in expression of the esteem of this community for the service you have rendered it.

Yours sincerely,

W. H. WRIGHT,
Director.



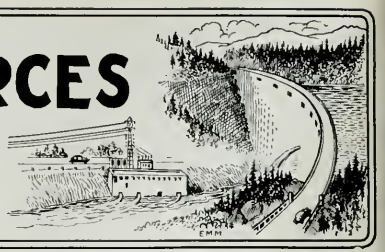
DIVISION OF WATER RESOURCES

OFFICIAL REPORT

FOR THE MONTH OF

February, 1937

EDWARD HYATT, State Engineer



On request of the Kern County Board of Supervisors, regarding organization of the new Kings River Delta Irrigation District, a field investigation was made to determine feasibility of the project. The district embraces an area of 3100 acres of developed land bordering the Kings River channel south of Stratford.

The Orange Cove Irrigation District, previously approved was organized at an election held February 16, 1937. The vote cast was 160 to 1 in favor of forming the district, indicating strong support of the Central Valley Project which will furnish a water supply to the area through the Friant-Kern Canal.

First steps toward construction of Imperial Valley Irrigation Districts power program were taken on February 15, 1937, with the opening of bids by the Bureau of Reclamation for construction of four drops and power plant structures on the All-American Canal.

FLOOD CONTROL AND RECLAMATION

Sacramento Flood Control Project

During this period two rain storms occurred which necessitated the operation of the three drainage pumping plants on the Sutter By-pass from February 5th to February 22d. A small amount of routine maintenance work has been done, including blading the roads on the levees. The dragline excavator has continued clearing the canals tributary to Pumping Plant No. 2.

During the two freshets in the upper Sacramento River, both of which crested at 23.1 feet at Colusa on February 6th and February 15th, the Butte Basin levee was patrolled and minor repair work done as needed. This consisted mostly of filling the deeper cracks caused by rain water drainage in the new levee, and dragging the levee crown to prevent side erosion from drain water.

Relief Labor Work

Clearing of the flood channels of the Feather River north of Marysville has proceeded with a relief labor crew of approximately 120 men. Several days were lost on account of rain, but, according to the new regulations, this is made up during the period. State Relief Administration Camp No. 7 in the Sutter Basin has furnished approximately 50 relief men during this period for clearing in the Tisdale By-pass.

Bank Protection Program

So far as has been observed, no difficulties have appeared in the bank protection work recently completed by the War Department, although twice in this period the water stage on the Sacramento has reached a point above the bank paving.

WATER RIGHTS

Supervision of Appropriation of Water

Twenty-four applications to appropriate water were received during January; 19 were denied and 14 were approved. During the same period 20 permits were revoked, and 2 licenses were issued.

The Cedarville Water Master District on Pine Creek in Surprise Valley, Modoc County, was created by Order of the Division of Water Resources, dated January 13, 1937. A petition signed by eighty per cent of the owners of the conduits lawfully entitled to divert water from Pine Creek, requesting that a water master be appointed for said District has been received by the Division and water master service will be rendered on the stream during the 1937 irrigation season. The District embraces 1280 acres of irrigated land served by 22 ditches. The decreed rights of the water users within the District total 16.5 cubic feet per second of water.

SUPERVISION OF DAMS

Amended application for approval of plans for construction of Mad River dam of the city of Eureka was filed on February 5, 1937. This structure is to be 110 feet in height with a storage capacity of 18,000 acre-feet. The estimated cost is $980,000. This application was approved on February 19, 1937.

The application for approval of plans for the enlargement of Danhauser dam, owned by P. C. Weber, Alturas, California, was approved on January 15, 1937.

Application for approval of plans for construction of the Mowich dam in Modoc County, owned by Everett E. Caldwell, Canby, was approved on January 25, 1937.

Amended application for approval of plans for construction of the Copper Basin dam of the Metropolitan Water District, Los Angeles, was approved on February 15, 1937. This dam is to be 180 feet in height and store 22,000 acre-feet.

Amended application for approval of plans for the construction of Gene Wash dam of the Metropolitan Water District, Los Angeles, was approved on February 15, 1937. This is to be a concrete arch structure 126 feet in height and storing 6,300 acre-feet.

Work on Judson dam, owned by the California Water and Telephone Company, to furnish equalizing storage for water distribution has been completed and the dam put into service.

Work is progressing satisfactorily on the construction of San Gabriel Number 1 dam of the Los Angeles County Flood Control District and on Cajalco dam of the Metropolitan Water District.

SACRAMENTO-SAN JOAQUIN WATER SUPERVISION

Early in February, a storm caused a rapid rise in the streams in the Sacramento Valley, with the consequence that the flow at Sacramento increased from 10,000 c.f.s. on February 4th to a maximum of 63,000 c.f.s. on February 7th. This peak flow has gradually subsided and the flow at Sacramento is now about 25,000 c.f.s.

The storms in the San Joaquin Valley, during February, did not cause as rapid a rise in the San Joaquin River at Lathrop. The peak flow was reached there on February 22d, with a discharge of 15,200 c.f.s. The increase in the flow of the valley streams has caused a marked decrease in the salinity in the delta area.

California Cooperative Snow Surveys

In the latter part of January and early February the first snow surveys of the 1937 season were made at key courses throughout the major drainage basins on the west side of the Sierra. The collection of this data was made under exceptionally adverse conditions. The abnormally low temperatures (in individual cases the lowest of record), that prevailed during the month of January prevented any consolidation of the snow pack as it gathered in the mountains and traveling either by skis or webs, on account of the deep, loose, powdery snow, was a slow, laborious process. Operations were further hindered by the unsettled, stormy weather that began during the last few days of January and continued through the first week of February. Many highways normally open to traffic all winter were blocked by heavy snow drifts and telephone lines to many mountain resorts were down.

Harry A. Hopkins Resigns as Head of Highway Board

In order that he might be free to campaign for election to succeed the late Henry E. Stubbs of Santa Maria, Representative in Congress from the Tenth District, Harry A. Hopkins of Taft presented to Governor Frank F. Merriam on March 9 his resignation as chairman of the California Highway Commission.

Appointed a member of the Highway Commission by the late Governor James Rolph, Jr., in January, 1931, Mr. Hopkins was named chairman of that body in October, 1932, when Earl Lee Kelly of Redding was elevated to the office of Director of Public Works.

Mr. Hopkins has resided in Taft since 1909 and was that city's first mayor following its incorporation in 1910. As an organizer of the Kern County Chamber of Commerce, he served as chairman of that civic body's finance and highway committee and for many years has been interested in highway work. He is chairman of the administrative committee of the American Association of State Highway Officials.

CAUTION SIGNS USED TO SHOW MOTORING HAZARDS

(Continued from page 10)

wording. Obviously, it is very essential that the motorists should not be confronted with numerous caution signs having wording with which he is not familiar. If standards are maintained the motorist observes and reacts.

New signs like fresh paint attract attention because they are different, but the attention quickly fades if the motorist obtains the feeling that he is being subjected to too much information concerning how he should drive. Observations have proved the fact that, in general, motorists will obey warning signs when they are convinced that such signs are placed only at points where advance warning is needed for their safety.

It requires the misuse of only a relatively few signs to cause disrespect and weaken the effect of all signs.

"Was your friend shocked over the death of his mother-in-law?"

"Shocked! He was electrocuted."

How Traffic Accidents are Analyzed for Permanent Record

THE serious question of traffic accidents has always been of first importance to all departments of the Division of Highways. Its increasing complexity and the diversity of opinion expressed among those most deeply interested, pointed to the necessity of providing all the data available in such a manner and in such degree of detail that they could be studied in all the varying combinations.

A wealth of data had been accumulated at different times regarding totals for various types or classes or categories. Any attempt to use such data in reaching a satisfying conclusion invariably led to the inescapable fact that accidents result not because of the existence of many isolated circumstances but from certain combinations of circumstances, any one detail of which may vitally affect the worth of the conclusion reached regarding the real cause of accident.

AN ENGINEER ASSIGNED

At the beginning of the past year an engineer was assigned the duty of outlining and supervising the accumulating and analyzing of all available data concerning motor vehicle accidents on the rural portion of the State highway system.

His selection was a natural one, inasmuch as he was thoroughly familiar with highway traffic through his work during the State-wide transportation survey of 1934 and in supervising the regular traffic studies of the maintenance department. A study of motor vehicle accidents that fails to include the facts of the accompanying traffic loses much if not all of its value.

Through an arrangement of many years' standing the Department of Motor Vehicles has furnished the Division of Highways with copies of all reports received covering accidents that occur on the State highways. These reports are carefully studied and coded in such detail that practically every pertinent fact can be recorded on a tabulating machine card. It is only in this manner that it is possible to make the various complex combinations which are absolutely essential to such a study.

CONDITIONS PROMPTLY CORRECTED

In addition to the resultant tables which form the basis for conclusions along lines of general policy, the examination of individual reports makes possible the immediate correction of particular conditions which are shown to require attention. These matters are taken up directly with the various District Engineers for appropriate action.

As the reports accumulate they are regularly recorded and filed by county, highway route, and section; and in this manner any unusual concentrations are easily detected. Special studies are made of the reports for these points; and if from such study no definite cause can be found, a comprehensive survey of actual conditions is made in the field.

PERMANENT STUDY PROVIDED

This general procedure during the past year has resulted in the correction of many individual conditions of both major and minor importance, and the various analyses made have been of notable value in clarifying many questions which concern the design, construction, and operation and maintenance of the highways in the State.

The assignment is a permanent one, for the study must be continuous. It is indispensable that there be at all times definite, dependable data, not alone on accidents in general but that this data may accurately reflect the conditions on the highways of California.

The tabulation of accidents and their causes on rural State highways for the year 1936 will appear with complete detail in the April issue of this magazine.

"It's true, isn't it, that the hand that rocks the cradle rules the world?"

"I don't find it so."

"G'wan! You know your wife is the boss."

"Yes, but being boss she makes me rock the cradle."

New Edge Cutting Device For Plant-Mix Oil Surface

By J. C. ADAMS,
Resident Engineer

AN economical and time saving device for edge cutting of plant-mix oil surfaces of highways was recently developed in District V of the Division of Highways.

The new device was tried out successfully on an 8-mile road construction project between Soledad and Gonzales in San Luis Obispo county. This job consisted of 0.21 feet by 20 feet plant-mixed surfacing placed over the existing Portland cement concrete pavement or over 0.46 feet crusher run base, with 8 feet by 0.33 feet road-mixed borders.

Since no header boards are used on plant-mixed surfacing, an irregular border line often occurs at the pavement edge. To overcome this difficulty the edge-cutting device now in use was developed by the writer and the contractor, A. J. Raisch Company.



Disc attachment cuts compacted earth shoulders before placing plant-mixed surface on road.

The device consists of an ordinary automobile axle and hub equipped with roller bearings, to which is fastened a 24-inch diameter farm disc bolted to the hub, for use as a cutting edge. A shank of the original axle, 20 inches long, supports the disc and is bolted to the moldboard of the power grader by two ¾-inch U-bolts. The overall length from the tip of the hub to the end of the shank is 30 inches. About 15 minutes time is required to attach and remove the assembly from the moldboard.

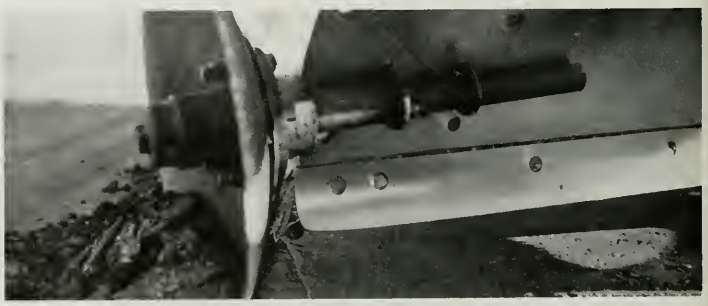
The first use of the disc attachment was in cutting a true edge along the earth shoulders prior to spreading the plant-mixed surfacing. The earth shoulders were previously watered and mixed by a spring-tooth harrow, after which they were rolled with a 12-ton roller. The shoulders were then cut while still green, and after drying out afforded a good lateral support and a well defined edge for the proposed paving.



Close-up view of disc used for cutting dirt headers. It is fastened to auto axle and hub.

The operator of the grader was aided in maintaining a true line during the cutting operation by stretching a chalk line between points placed at 400-foot intervals.

After the plant-mix surface was completed and before road-mixing the shoulders, the center line was re-run and points set at 400-foot intervals on tangents and 50-foot on curves. The oiled surface edge was then cut to form a true border for the oil-mix shoulders.



This is front view of disc cutting attachment showing U-bolt fastenings to moldboard.

Storm Damage to Highway System Totals $1,000,000

(Continued from page 16)

Route 80—through San Marcos Pass, with 7000 cubic yards, were closed to traffic temporarily.

Major damage in District VI, including Tulare and Kern, may be summarized as follows:

ROUTE 10, between Lemon Cove and Sequoia National Park, and east of Visalia—a total distance of some 25-miles—was affected by overflow water. The run-off was so rapid that existing drainage structures could not carry the flow. Sections of shoulders and roadway were washed out, and pavement undermined or damaged.

KAWEAH RIVER RAMPAGES

ROUTE 129, between Woodlake and the junction of Route 10—approaches to two bridges were washed out by flood waters in the Kaweah River. One structure collapsed and the approaches were washed out. The second bridge was moved downstream and lodged against two trees. The condition here was typical of conditions to be expected at locations where floods occur only once in several years. The accumulation of brush and debris brought down from the overflowed area above the highway chokes the waterway, with resulting overflow and damage.

ROUTE 131, Cottonwood Creek overflowed in the vicinity of Woodlake, damaging the bridge, as well as washing out shoulders and undermining the concrete pavement. East of Woodlake, water overflowed the pavement to a depth of four feet.

ROUTE 135, west of Earlimart, flooded and was closed to traffic.

KERN COUNTY DAMAGE

ROUTE 4, north of Famosa, on the Valley route—overflow water damaged shoulders.

ROUTE 142, closed to traffic temporarily when bridge across Pozo Creek was washed away. Traffic is being cared for over a temporary fill until a new bridge can be constructed.

Between Bakersfield and Glennville, on this same route, there was considerable damage due to flooding at locations where existing drainage structures were inadequate. The bridge at Glennville was damaged and made unsafe for traffic. Likewise, the road from Glennville east to about two miles from the Kern River Canyon route was closed to traffic.

ROUTE 57, between the entrance of the Kern River Canyon and Bodfish—the river flooded the highway to a depth of five feet at several places, with resulting loss of embankment and roadway. The estimated cost of replacement of fills, roadway, etc., is $25,000.

ROUTE 58, just west of Bakersfield—the bridge across Kern River Overflow Channel collapsed and considerable damage was done to road shoulders.

ROUTE 139, south from the junction with Route 58—overflow from the Kern River washed out approaches to two bridges.

Slippery Roads Are Made Safe For Motorists

(Editorial from Tulare Times)

Motorists traveling over the valley highway will notice that a "rough surface" is now being applied to many sections of pavement which previously were quite "slippery" in wet weather.

This is a particularly helpful improvement to safe driving and one on which the State Highway Department is deserving of especial commendation.

Our highway officials are doing everything in their power to make the roads safe for motorists. And if all drivers would respond with the same amount of thoughtful consideration for their own lives and limbs, the frightful traffic toll would soon reach the vanishing point.

"Give me a sentence with the word 'vermin'."

"Before I go fishing', I go vermin."

Dentist—Pardon me a moment, sir, I must have a drill.

Patient—Can't I even have a tooth fixed without a rehearsal?

"Cat's Whisker" On Bay Span Is Boon to Drivers

WHEN motorists passing through the toll gates of the San Francisco-Oakland Bay Bridge receive an electric shock as they pay their fare, it is not a practical joke played on them by a whimsical toll collector. It is, as a matter of fact, a serious problem, which Chief Engineer C. H. Purcell and his staff believe they have finally solved after much experimentation.

Automobiles, especially those traveling at a good rate of speed, gather an electric static which communicates itself through the body of the motorist when his fingertips touch those of the toll collector. The method adopted to eliminate this static at the toll gates of the San Francisco-Oakland Bay Bridge is based on the same principle used by gasoline trucks. These vehicles carry a chain which drags upon the road, thus grounding this static.

STATIC IS GROUNDED

In the case of the San Francisco-Oakland Bay Bridge No. 18 piano steel wire is used, approximately 1/20th of an inch in diameter and 14 inches high above the pavement. This wire has a coil spring bolted in a slot 4 inches long and about 1 inch deep and 2 inches wide set in the paving some few feet in front of the toll gate. This spring wire, known also as the "cat's whisker," terminates in a coil which is bolted to the concrete and grounded by an electric conductor.

The "cat's whisker" taps the front axle of the automobile as it approaches the toll collector and thus grounds the static so that the motorist and the collector may safely exchange fares.

Because of the delicacy of these wires, it is necessary to replace them every few days and a daily inspection is made.

All-steel bodied cars, having a large amount of rubber insulation, are the greatest offenders.

Some consideration was given to the so-called "squirt" idea to eliminate static, as used now in the New York Triborough Bridge. While this has its merits, according to Chief Engineer Purcell, it nevertheless has received considerable complaint.

Highway Bids and Contract Awards Made in February

ALAMEDA, CONTRA COSTA, SANTA CLARA COUNTIES—Furnish and apply Diesel oil to roadside vegetation about 111.5 roadside miles. District IV, various routes. Lee J. Immel, Berkeley, $3,741; Garcia Construction Co., Irvington, $4,095; Hayward Building Mtl. Co., Hayward, $4,575; Tieslau Bros., Inc., Berkeley, $4,320. Contract awarded to Pacific Truck Service, Inc., San Jose, $3,330.00.

CALAVERAS, STANISLAUS, TUOLUMNE, AND AMADOR COUNTIES—Applying Diesel oil to roadside vegetation over a distance of about 176 roadside miles, in District X, various routes. Garcia Construction Co., Irvington, $3,937; Lee J. Immel, Berkeley, $4,050. Contract awarded to Sheldon Oil Co., Suisun, $3,112.50.

MERCED, MARIPOSA, STANISLAUS, SAN JOAQUIN, CALAVERAS, AMADOR, TUOLUMNE CUNTIES—Applying Diesel oil to roadside vegetation over a distance of about 263 roadside miles District X, various routes. Sheldon Oil Co., Suisun, $5,246; Tieslau Bros., Inc., Berkeley, $6,390; Hayward Bldg. Mat. Co., Hayward, $7,101; Lee J. Immel, Berkeley, $6,136. Contract awarded to Pacific Truck Service, Inc., San Jose, $5,129.80.

RIVERSIDE COUNTY—Reconstruction of timber bridge across Santa Ana River near Prado District VIII, Route 77, Section E. George Herz & Co., San Bernardino, $11,900; Dimmitt & Taylor, Los Angeles, $9,872; Harry Friedman, Los Angeles, $11,818; Gibbons & Reed Co., Burbank, $11,826. Contract awarded to Sou. California Roads Co., Los Angeles, $7,932.89.

SAN BENITO, MONTEREY, SAN LUIS OBISPO, AND SANTA BARBARA COUNTIES.—Apply Diesel oil to roadside vegetation District V, Routes 2, 22, 119, 10, 137, 58, 56, 147, 57, 80, 149, 56, various sections. Pacific Truck Service, Inc., San Jose, $7,827; Bradley Truck Co., Santa Maria, $8,158; Tieslau Bros., Inc., Berkeley, $8,410; L. A. Brisco, Arroyo Grande, $8,473; A. J. Clausen, Berkeley, $8,568; Western Motors Transfer, Inc., Santa Barbara, $10,363. Contract awarded to Bert Hale, Pismo Beach, $6,583.50.

SONOMA, MARIN AND NAPA COUNTIES—Furnish and apply Diesel oil to roadside vegetation about 118.5 roadside miles District IV, various routes. Basalt Rock Co., Inc., Napa, $6,825; E. A. Ford, San Anselmo, $6,450; Lee J. Immel, Berkeley, $6,925; Hayward Building Mtl. Co., Hayward, $8,250; Tieslau Bros., Inc., Berkeley, $7,300. Contract awarded to Chas. Kuppinger, Lakeport, $5,975.00.

"Can you imagine anyone going to bed with his shoes on?"

"Who does that?"

"My horse."

Patient (nervously)—And will the operation be dangerous, doctor?

Doc—Nonsense! You couldn't buy a dangerous operation for $40.

The White Line

Throughout the length of our great state
For your safety and mine,
Down the center of each highway
Is a broad white line.

Through heavy storm or densest fog
We drive without a care,
As we watch the center of the road,
Seeing the white line there.

How many wrecks have been averted
By drivers everywhere,
As they drove through crowded traffic
And the white line was there.

Sincerest thanks to road officials
For every post and sign,
But the thing that makes us safest
Is the broad white line.

—ANGIE DOWNES,
Santa Rosa, California.

Highways Made Beautiful

The State Highway Department deserves commendation for the manner in which it has been planting shrubbery along the barren cutbanks and grades of the new Nojoqui cutoff, as well as for retaining several pieces of property over which the old pavement made elbow bends, and converting these into park spaces. In a few years, the Nojoqui drive is going to be charming as a result of this planting work, if the shrubs and trees are kept properly watered during dry periods.

—Santa Maria Times

Plan Panama Highways

As a result of the recent ratification of the new treaty by the Congress of Panama governing the relations of that country with the United States, the Central American Republic is ready to proceed with the work of completing a 16-mile stretch of the Trans-Isthmian Highway, according to Leopoldo Arosemona, Secretary of the Department of Public Works and Hygiene of Panama.

Mr. Arosemona so announced at the Thirty-fourth Annual Convention of the American Road Builders' Association held at New Orleans. The new Panamian highway will be built through a mountainous country where the cost of excavation and filling is high.

He also said that another highway project which his government intends to launch at an early date is a 100-mile stretch between David and the Costa Rican border. This road will form a link in the Pan American Highway.

Bay Bridge Crew Gave Service to 2249 Machines

A TOTAL of 2249 vehicles have been serviced by the Maintenance Crew of the San Francisco-Oakland Bay Bridge since the structure was opened on November 12, 1936, to March 1, 1937, according to a report received by State Director of Public Works Earl Lee Kelly from Chief Engineer C. H. Purcell.

Of the 2249 vehicles serviced in the past three and a half months, 1294 included vehicles supplied with gasoline; 694 were vehicles towed because of engine trouble, accidents, etc.; 250 tires were changed; and 9 fires were put out.

February figures were:

Vehicles supplied with gasoline	305
Vehicles towed because of engine trouble or accidents	158
Tires changed	79
Fires	1
Total vehicles serviced for February	543

Average number of vehicles serviced per day for the month of February was 19.4. Average number for three and a half months, 20.6.

The total of 543 vehicles serviced for the month of February compares with 553 serviced for January.

Since the bridge was opened, there have been 43 accidents on the structure and its approaches. Twenty-seven of these accidents involved personal injury, with the total number of persons injured, 50. There were four accidents resulting in fatalities.

February figures are:

	On bridge	On approaches
Total accidents	4	8
Involving personal injury	3	2
Persons injured	9	3
Fatal accidents	2	0

In respect to last month's fatal accidents on the bridge, the drivers of the cars, Lewis George and L. M. Doyle, were charged with negligent homicide.

"More and more motorists crossing the bridge are learning the value of the maintenance-call boxes which are placed at intervals along the entire structure," Mr. Kelly said. "The Bridge Maintenance Service is for the convenience of motorists and we are anxious that they avail themselves of it whenever they are in difficulties on the structure."

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Department of Public Works

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EARL LEE KELLY_____Director

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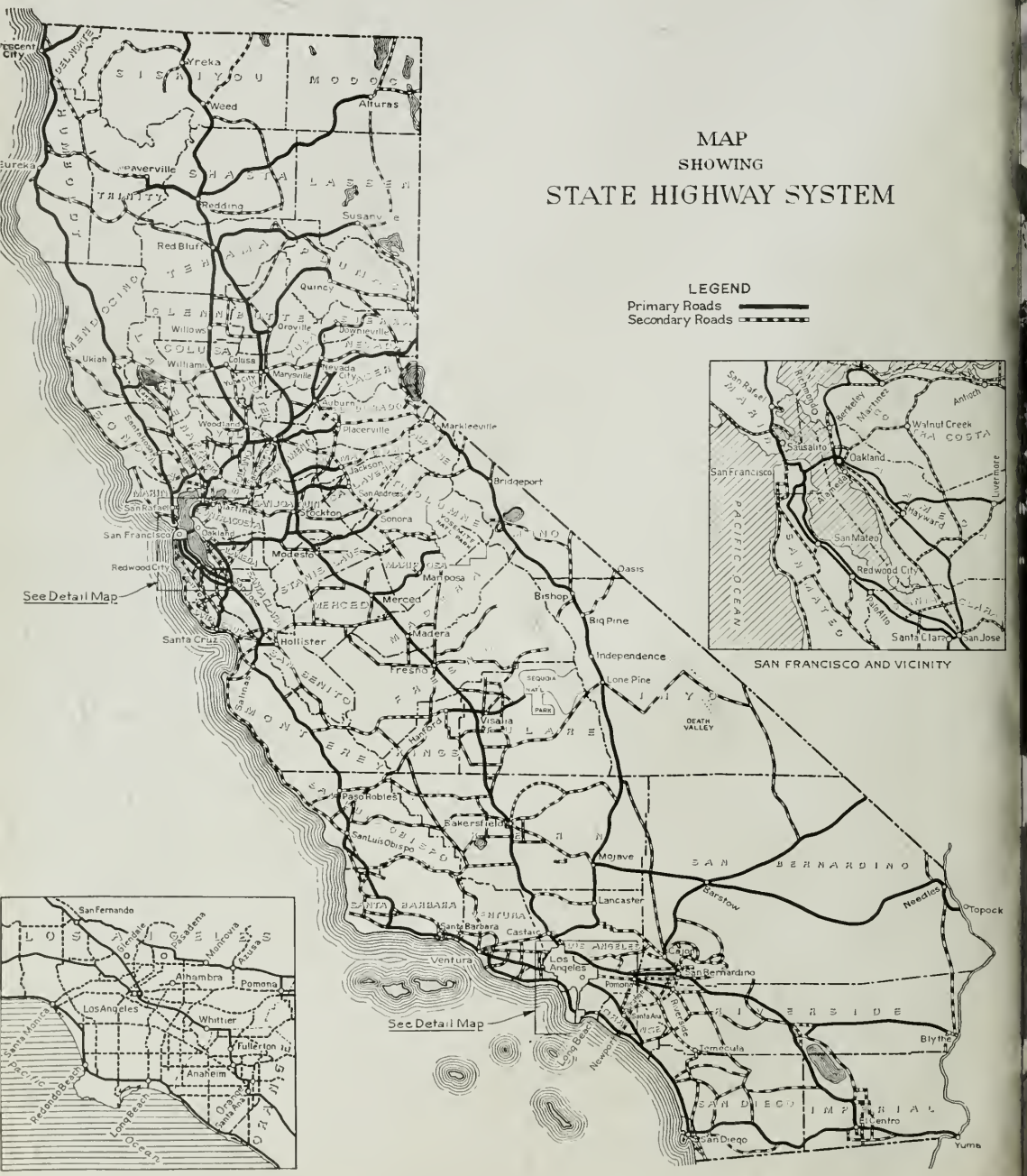
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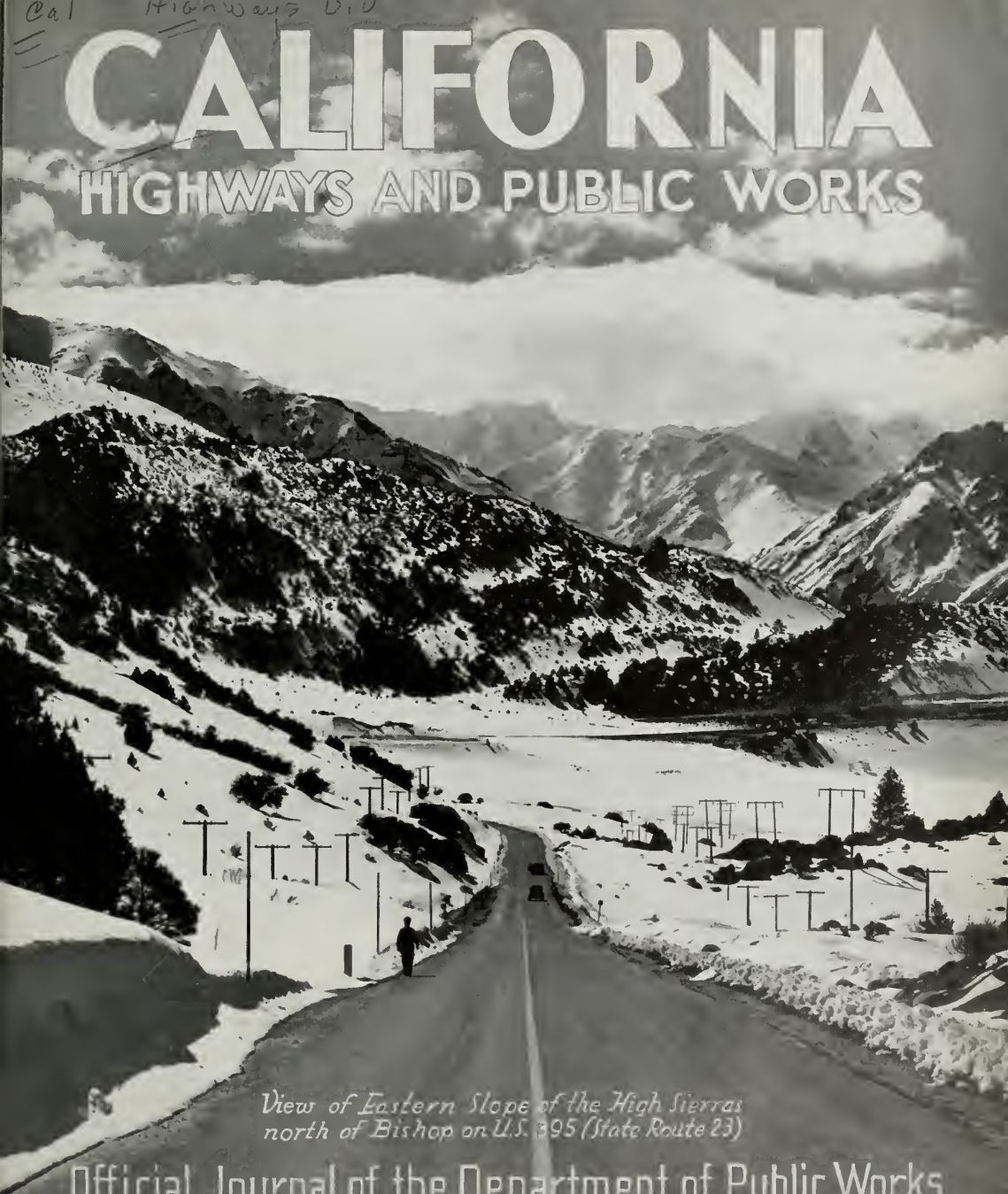


SAN FRANCISCO AND VICINITY

LOS ANGELES AND VICINITY

Cal Highways Div

CALIFORNIA
HIGHWAYS AND PUBLIC WORKS



View of Eastern Slope of the High Sierras north of Bishop on U.S. 395 (State Route 23)

Official Journal of the Department of Public Works

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CALIFORNIA HIGHWAYS AND PUBLIC WORKS

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EARL LEE KELLY, Director C. H. PURCELL, State Highway Engineer JOHN W. HOWE, Editor

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Vol. 15 APRIL, 1937 No. 4

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Annual Survey Shows Rural Road Accidents Keep Pace With Normal Traffic Growth

By T. H. DENNIS, Maintenance Engineer

WHILE total traffic on rural roads of California's State Highway System increased approximately 12 per cent during the last six months of 1936, the number of accidents increased 38 per cent.

This is revealed by the second six months' survey of accidents for last year just completed.

In reviewing the records for the entire twelve months' period for the year 1936 it is found that 7665 accidents involving motor vehicles were reported as having occurred on the rural portion of the State highway system. This compares with a total for 1935 of 6824, showing an increase of 12 per cent, which corresponds very closely with the increase in total traffic during the same period.

However, the total accidents reported for the first six months' period numbered only 3209, considerably less than 50 per cent of the year's total.

The increase in the number of accidents may be accounted for to some extent by the fact that the vacation period for nearly everyone comes during the second half of the year and there is a correspondingly large amount of travel in unfamiliar surroundings. However, one is forced to the conclusion that those who drive, and that means nearly all of us, fail to realize or simply refuse to recognize that driving a motor vehicle can never be an automatic process and that unless care and judgment are exercised at all times the inevitable result is accident.

TWO TYPES OF ACCIDENTS

Although the accident rate for the full year is higher than was observed when summarizing the first six months' period, the general patterns as to location, type, and contributing causes remain much the same.

In general the accidents reported have been considered in two main groups: those where only a single motor vehicle was involved and those involving two or more motor vehicles. This is for the reason that in single-car accidents the question of traffic is largely eliminated. Accidents in each group, and the combination of the two, have been analyzed as to type, location with respect to lane widths of roadway, and the reported contributing causes.

A separation of single-car accidents into the natural divisions of "Collision," "Noncollision," and "Pedestrian" results in respective percentages of 36 per cent, 44 per cent, and 20 per cent. These figures for the full year show very little change from corresponding percentages of 35 per cent, 46 per cent and 19 per cent found in the analysis of the first six months' period. Taking more specific categories, "Drove off road" and "Turned over" account for 40 per cent of all single-car accidents, the same percentage found for the first six months' period. "Collision with pole or tree" 11 per cent, "with bridge or culvert" 6 per cent compare with previous percentages of 10 per cent and 5 per cent.

TWO-CAR MISHAPS

Where more than one motor vehicle is involved the "Course being pursued" provides probably the most satisfactory group basis for review.

Vehicles "Approaching each other on the same road" accounted for 42 per cent of all two-or-more-car accidents; "Overtaking on the same road" 29 per cent; "Paths intersecting while traveling the same road" (including left or U turn, right turn, coming out of parking space) 16 per cent; "Paths intersecting but while vehicles were traveling different roads" 12 per cent. This group covers the commonly designated intersection accident and includes intersections with private roads.

These accident types have been grouped to show various relationships when the different lane widths of roadway are also taken into consideration.

HEAD-ON COLLISIONS

"Approaching" accidents as noted above are by far the most numerous of all types and naturally the most serious, being made up of direct head-on collisions and side-swipe head-on collisions. **This type constituted approximately 46 per cent of the two-lane accidents, 33 per cent of the three-lane, and 21 per cent of the four-lane. These percentages show some slight change from the first six months' figures, which were 44 per cent, 38 per cent, and 20 per cent. They would seem to indicate that as the number of lanes is increased the approaching type of accident decreases.**

"Overtaking" accidents, made up of direct and modified forms of rear-end collisions, are the second most numerous of the four main groups, being respectively 27 per cent of all two-lane accidents, 34 per cent of the three-lane, and 39 per cent of the four-lane. The first six months' period showed respective percentages of 29 per cent, 33 per cent, and 36 per cent.

Here we find a reverse tendency from that noted with respect to the "approaching" type, in that rear-end collisions are of much less frequent occurrence than head-on collisions on two-lane roads, while they are of slightly greater frequency on three-

(Continued on page 8)

New Los Gatos-Santa Cruz Highway Saves Five Miles

By JNO. H. SKEGGS, District Engineer

ANOTHER link in the improvement of the Los Gatos-Santa Cruz Highway, Route 5, one of the heaviest traveled recreational and business highways of the State, was recently completed with the opening to travel of the Scott's Valley reconstruction at the Santa Cruz end, affecting a saving of 5 miles.

This highway connects the Santa Clara Valley with Santa Cruz bay districts, climbing over the Santa Cruz mountain spur of the Coast Range, and is the main access road from the San Francisco bay cities to the vacation resorts in the mountains and the seashore playground of the Santa Cruz area.

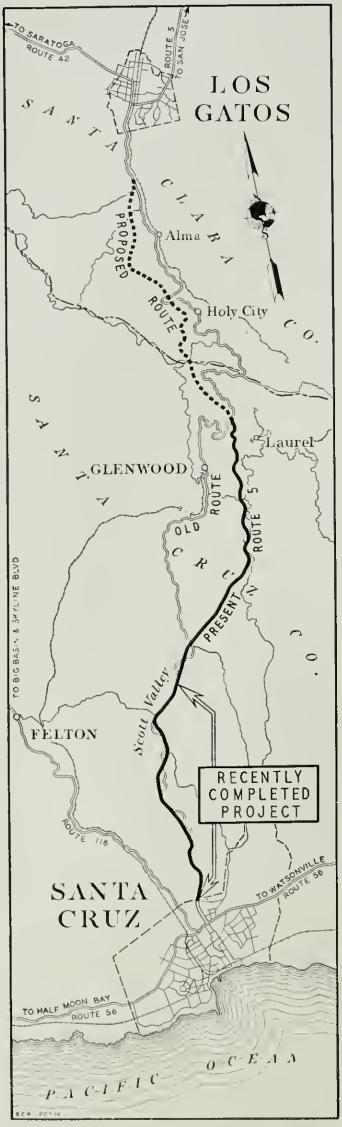
Since the early days of the automobile, this road has been popular with Bay District motorists, and was among the first of the mountain roads to be selected for improvement after the creation of the California Highway Commission.

FIVE MILES SHORTER

Early construction followed a new alignment through virgin country for the greater portion of its distance, and was considered a bold location for its day. A glance at a map showing the old State highway and the new and proposed relocation, with an indicated saving of 5 miles in distance, will serve to show what great changes have occurred in location standards.

Before 1920 the travel had become so heavy that the graveled surface was totally inadequate to carry the traffic. About that time the major portion of a 25-mile stretch was surfaced with a 15-foot concrete surface, widened on the curves; and, since most of the road was on curves, there was very little that escaped this widening.

Within a few years this improvement also became inadequate, and on Sundays and holidays it was often impossible to get out of line in the entire 25-mile trip.



Some relief was afforded by the improvement of the Skyline Boulevard and other parallel roads constructed by the State and the counties, but this route, being the most direct, continued to draw the bulk of the travel.

TRAFFIC RELIEF IMPERATIVE

Further relief was thus imperative, and studies were undertaken a number of years ago to determine the best routing, which resulted in a recommendation for a radical change of location and reconstruction on a new line.

The first contract under this program was let in 1932 and provided a four-lane highway through the heavy mountain sections where curvature is naturally limited, and a three-lane construction through the valleys and flats where easier curvature alignment could be secured. Contracts for further improvement have been continuously under way since 1932.

The high light of the recently completed project in Santa Cruz County, between Scott's Valley and one mile north of Santa Cruz, is the straightening of the old highway through the well-improved and subdivided Scott's Valley.

CURVATURE STATISTICS

The following statistics of curvature and length afford a graphic picture between the old and the new:

	No. of Curves	*Total Curvature*	*Minimum Radius*	*Length of Line Miles*
Present	34	1586° 38′	100	4.23
Proposed	12	351° 36′	750	3.93
Difference	22	1235° 02′	---	0.30

This is a country of heavy winter rainfall, with a light, sandy easily eroded top soil. The weather and the soil conditions foster plant growth, and formerly many fine stands of redwood were found throughout the valley. The steeper gulches are still

(Continued on page 17)



Views of improvement of Scott's Valley link of the Los Gatos-Santa Cruz Highway during and after construction. Upper left: Scene showing grade construction work. Upper right: Section of completed highway at same point showing width of pavement. Center: Looking north toward Camp Evers on newly finished highway. Lower left: Drain being laid under subgrade. At right: Excavation in rock formation for installation of side drainage.

Building Divided Highway Link on L. A.-Pomona Airline Lateral

By R. J. HATFIELD, Resident Engineer

WIDENING of the last section of the realigned Los Angeles-Pomona Lateral which will provide a 27-mile direct line highway forty feet wide with only two electric "Stop and Go" signals and only two boulevard "Stop" signs for its entire length will be completed next month.

Originally a pioneer mail route, this super-highway, then a county road, was taken into the State highway system by the Legislature in 1931. Improvement operations were started in 1932 and this month saw the laying of the last stretch of widened concrete pavement on this unusual airline thoroughfare.

Starting at a point three-quarters of a mile east of the Los Angeles City Hall, the highway runs through the southwest corner of Alhambra to the city of Monterey Park and thence to El Monte and through walnut orchards and orange groves and the rolling Kellogg hills to Pomona.

The completed highway will have a 40-foot concrete pavement with wide oiled shoulders and no grade intersections with major streets from the Los Angeles Civic Center to Pomona.

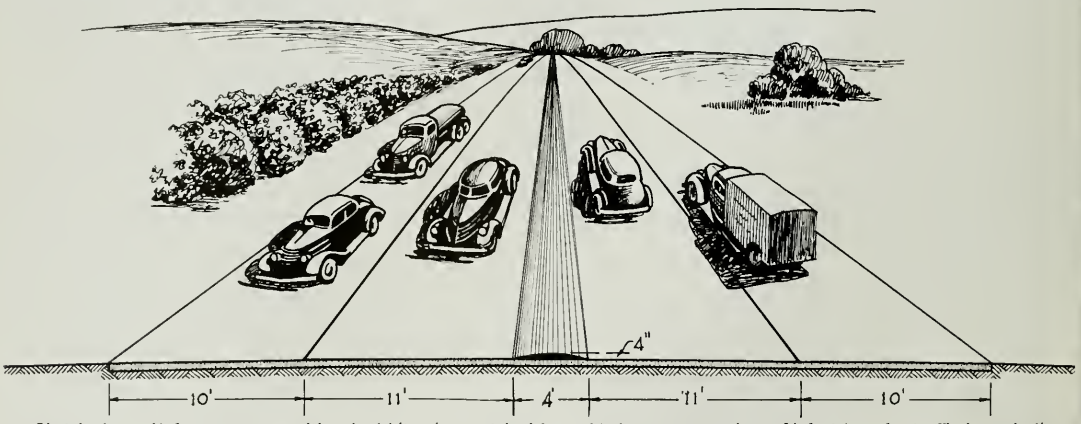
In the 50's Richard Garvey Sr., government letter carrier, packed the mail between Los Angeles and an army post on the Colorado River. It is related that Mr. Garvey, laying out the course he would pursue, followed the flight of crows eastward and westward and thus laid out a route that ran straight from Los Angeles to Pomona. Through Monterey Park and easterly, a portion of the present highway is known as Garvey Avenue, preserving by name the memory of the pioneer who first mapped it.

In 1931 the California State Legislature, aided by a large straight-edge and an accurate map, found Mr. Garvey's "navigation" good and adopted the forgotten mail route as a State highway, thus providing for an airline link in Southern California's most popular eastern and southwestern tourist and freight route which has definitely contributed to the present unprecedented development of the cities and communities to the east of the metropolitan center.

With the exception of existing county improvement on Garvey Avenue through Monterey Park and El Monte, and Holt Avenue west of Pomona, the newly adopted route traversed land intensely devoted to agricultural pursuits, walnut orchards and orange groves.

The necessary land, for highway right of way, valued at $2,000,000, was almost entirely secured by donation. The far-seeing property owners who wholeheartedly cooperated in the improvement, are today realizing benefits in the form of dividends from enhanced valuation of real estate, the annual aggregate of which far exceeds the estimated total right of way purchase value of 1931–32.

In 1932 construction operations were commenced on a portion of the new alignment. Contracts for grading, paving, bridges, grade separations, and landscaping were awarded and completed in rapid succession.



Sketch shows 46-foot pavement with raised bituminous strip 4 feet wide in center creating a 21-foot lane for traffic in each direction on easterly 6.3 miles of the new Los Angeles-Pomona Lateral. The strip is 4 feet wide in the center and feathered at edge to meet pavement.

BIG TRAFFIC INCREASE

In April, 1935, the last "Road Closed" barricades were removed and Southern California's 27-mile direct

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Views of realigned Los Angeles-Pomona Lateral, unusual airl ne highway, which provides a 27-mile stretch of road with only two "Stop and Go" signals and only two boulevard "Stop" signs for its entire length. Upper: Completed section of 40-foot pavement, widened from three to four lanes, west of Pomona. Center: Shows line of trucks dumping material used in laying additional 5-foot strip of pavement at left of roadway. Lower: Concrete mixer and mechanical finishers operating on Garvey Boulevard near Kellogg Hills one of links in new highway which will be completed in May. This project entailed the construction of a 10-foot widening strip and 8-foot plant mixed shoulders for a di tance of 18.7 miles.

Snow Removal This Season Will Cost State $500,000

W. A. SMITH, Assistant Maintenance Engineer

THE cost of snow removal from State highways during the 1936–37 winter season will be practically a half-million dollars on 5000 miles of road by the time all routes are open to traffic.

This is $150,000 more than required during any previous year.

There have been seasons when more snow fell at the higher elevations, and single storms of longer duration have been weathered. The increase in cost is due to a comparatively heavy fall in valley and foothill sections; the short time between storms, and drifting which blocked the roads behind the plows.

On two routes—the sections of U. S. 99 between Castaic and Grapevine in Los Angeles and Kern counties, and between Dunsmuir and Yreka in Siskiyou County—traffic was tied up or endangered where little trouble had been experienced previously.

ICE HAZARD ON RIDGE ROUTE

On the Ridge Route section, four storms occurred, with snowfall of from two inches to twelve inches in depth. Normally, this small quantity of snow is easily handled with the equipment available. The traffic is so heavy on this route that the snow was packed to ice almost as it fell and before the plows could clear the pavement. Few of the vehicles using this road were equipped with chains and, consequently, could not negotiate the slippery grades. The situation thus became hazardous at once. It was necessary for the traffic officers to close the road at various times to all traffic not equipped with chains until the ice could be scarified and bladed from the surface.

The section between Dunsmuir and Yreka is an area of reasonably heavy snowfall, and suitable rotary equipment is provided. The storms of late January and early February reached blizzard proportions, and the road was closed to traffic, except for one or two short periods, from January 31 to February 6 in spite of the efforts of snow removal crews.

VALUE OF SNOW REMOVAL

Snow removal work serves three distinct types of traffic: (1) through traffic, which includes trucks, buses and passenger cars engaged on the highways as a matter of business; (2) traffic which serves the more isolated communities and is more or less intermittent; and (3) the recreational traffic. The benefits to the people of the State can not be measured strictly on the basis of cost as compared to volume of traffic thus developed.

In the case of concerns engaged in hauling materials and supplies for example, there is a direct loss due to delays to their equipment whenever a regularly traveled road is closed by snow. There may also be a loss due to damage to the commodity—such as milk, fresh vegetables, etc. There is the further loss to the merchant and the consumer who are relying on delivery of such supplies.

SNOW SPORTS CONSIDERED

In the case of the small community, the ready means of transportation has established a dependence on the larger centers of distribution. Stocks of necessities must be replenished every few days and, while the number of vehicles which use a given road may be limited, the importance to the community served and the suffering which may follow on failure to keep open the line of communication may be very real.

The development of snow sports areas is a decided asset to the State. Such development relies on the ability of the highway organization to maintain an open road and, once resorts have been established as a result of snow removal operations, there is a definite responsibility to continue the service.

The considerations mentioned call for nice judgment and a certain amount of fortitude when proposals for extension of the service are presented. It is necessary to consider the following conditions: Will the grade, alignment and surface permit operation of the equipment required? Does the existing traffic demand and the probable development, within a reasonable period, justify the expense? Are funds available without seriously curtailing more necessary work?

UNCERTAINTIES INVOLVED

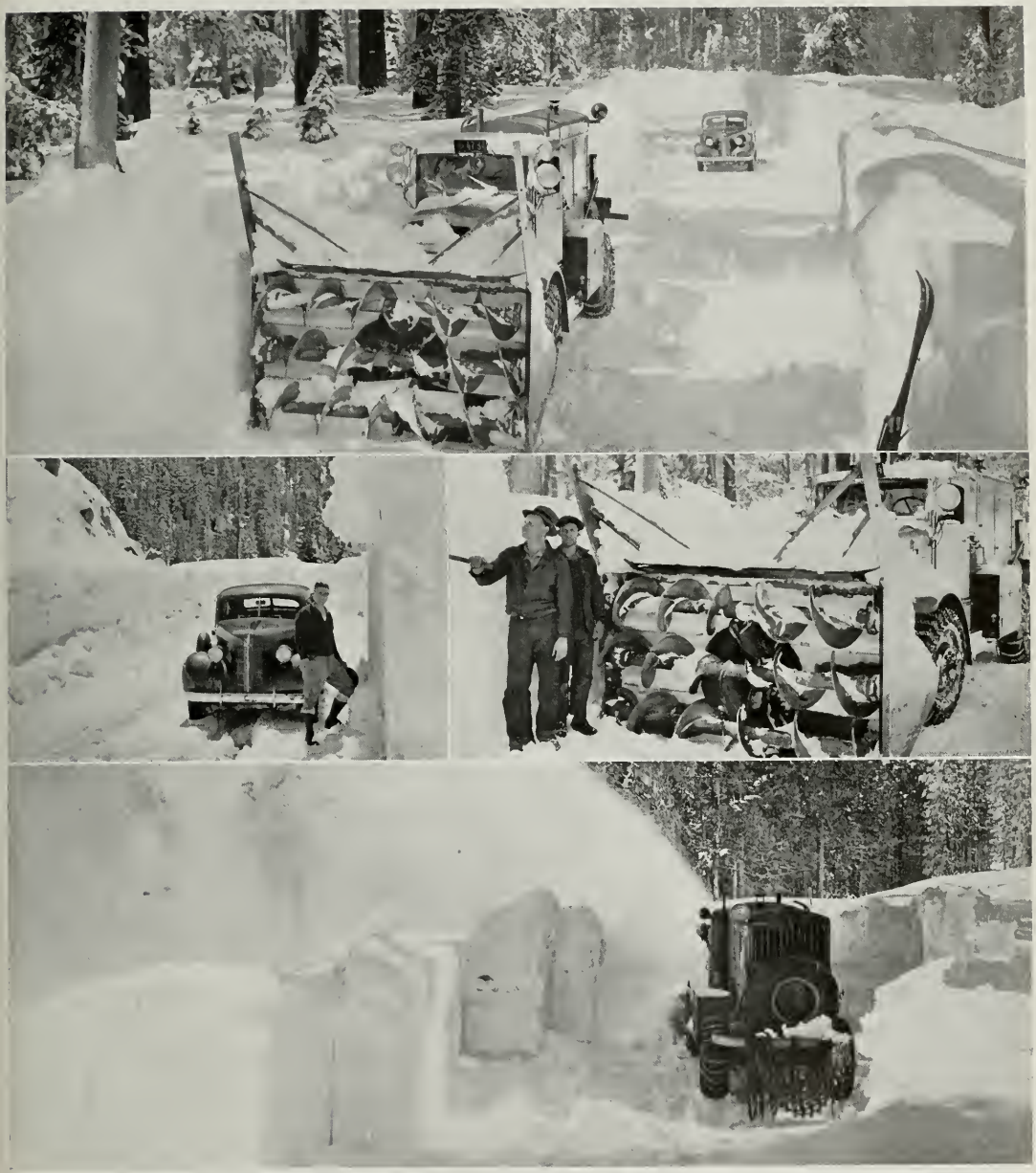
Even with the established program, the uncertainties of weather and traffic need can not be foreseen. It is essential, of course, to limit the organization and equipment. Each winter there is an equal chance that a minimum of equipment will take care of the situation. Actually, that was the case for three years prior to 1934.

On the other hand, during the past winter additional equipment requiring an investment of $250,000 could have been used to advantage for short periods of time. As several months are required to secure delivery, and since more equipment means more shop and living facilities, little can be done once the winter season has started.

The spirit of the men assigned to the mountain areas is admirable. The work is hard on men and equipment. During storm periods, operations are necessarily continuous. Many times it is not possible to provide a relief operator at the end of a regular shift. In such cases the men carry on until they can be relieved. Each member of the crew feels a personal responsibility for the success of the work.

The various Districts have furnished detailed information as to storm periods, records of snowfall,

(Continued on page 22)



At top—Snow removal operations in deep drifts of forest area on Placerville-Lake Tahoe link of U. S. 50 at Echo Summit with auger blower equipment. Center, left—A fifteen-foot drift on the Slippery Ford grade broken through for stalled traffic. Center, right—Close-up of auger blower rotary and crew, showing improved type equipment with three rows of augers. At bottom—Widening operations in the deep snow necessitate repeated backing up and bucking the banks at short intervals of progress.

Speed and Traffic Density Major Factors in Multi-lane Road Accidents

(Continued from page 1)

lane, and of very much greater frequency on four-lane. It seems natural to conclude that speed differential combined with greater average density of traffic must in large measure give rise to this situation.

CAUSES OF ACCIDENTS

The standards of alignment, grade, and surface average much higher on multiple-lane roads; and this fact, combined with the increased sense of freedom of movement that a wide road gives, undoubtedly tends to higher speed. If through speed excessive for the conditions that exist, a driver maneuvers himself into a position where his only choice is between an attempt to escape an oncoming car or one traveling in the same direction, he naturally chooses the one likely to cause the lesser impact.

Accidents resulting when the paths of vehicles intersect while both are traveling the same road, such as left turn, U-turn, right turn, and coming out from parking space, rank third in total number among the four general groups. Of all accidents reported for two-lane roads they account for 14 per cent, compared with 19 per cent for both the three-lane and four-lane. Here again, average density of traffic undoubtedly is of major influence. When the number of lanes is increased, it is naturally more difficult to move across these lanes of travel as is necessary in making a left turn. Left or U-turn accidents make up 90 per cent of the total in this general group. It may be found advisable on the more heavily traveled multiple-lane roads to entirely prohibit left or U-turns except at specifically indicated points.

The fourth and last of the main groups comprises those accidents that occur when the paths of vehicles that are traveling different roads intersect: the ones that happen where two roads meet or cross each other at grade. This type of accident accounts for 11 per cent of all reported accidents on both the two-lane and three-lane roads, and for 17 per cent on four-lane roads. These percentages are almost identical with those recorded for the first six months' period. They constitute somewhat less than 12 per cent of all accidents involving two or more cars. This comparatively small percentage is due to the fact that this study covers only rural State highways, where the number of intersections per mile is very much less than through incorporated territory.

Extreme cases where the traffic is exceptionally heavy on both intersecting highways, may justify actual grade separation; but the infrequency of such conditions, along with the very high initial cost of the structures, will always limit its application. The average speed on rural highways is relatively high, and for this reason it is particularly important to provide the maximum of clear unobstructed sight distance at all intersections.

COMBINATION OF CAUSES

Many accidents are the result of a combination of causes and it is not always possible or necessarily desirable to have the reporting officer indicate only one situation or action as being the cause of a particular accident.

Of the 7665 total accidents reported for the year, 2374, or 31 per cent, were those where only a single motor vehicle was involved. Corresponding with these 2374 single-car accidents, 2867 items of cause were reported as having contributed to their occurrence. In order of importance among the specific causes listed, "Speed excessive for conditions" is first with 22 per cent, having been noted in 638 instances. "Driver intoxicated or had been drinking" was reported 399 times or 14 per cent of all causes given. Pedestrians were involved in 486 cases or 17 per cent. A comparison on the same basis of percentage of all contributing causes reported for the first six months' period shows: "Speed" 21 per cent. "Driver intoxicated or had been drinking" 14 per cent, and "Pedestrian involved" 17 per cent. Minor causes for the full-year period were: "Driver asleep," 167 cases or 6 per cent; "Faulty tires," 157 cases or 5 per cent; "Wet pavement," 114 cases or 4 per cent. The percentages in these categories for the first six months' period were respectively 3 per cent, 5 per cent, and 3 per cent. There was a very sharp increase noted in the number of cases where drivers were reported as having been asleep.

Naturally, where two or more vehi-

Causes Contributing to Single Car and Two-or-More Car Accidents

(January 1, 1936–December 31, 1936)

Group	*Single Car*		*Two or More Cars*		*Total*	
	No. of Times Reported	Per cent of Total Causes	No. of Times Reported	Per cent of Total Causes	No. of Times Reported	Per cent of Total Causes
Condition of Vehicle	371	12.94	441	6.20	812	8.14
Condition of Driver	713	24.87	1560	21.94	2273	22.78
Speed	638	22.25	912	12.83	1550	15.53
Violation of Right of Way	282	9.84	3684	51.80	3966	39.74
Roadway	247	8.62	427	6.00	674	6.76
Pedestrian	486	16.95	23	0.32	509	5.10
Miscel. or Undetermined	130	4.53	65	0.91	195	1.95
Total	2867	100.00	7112	100.00	9979	100.00

NOTE: Total causes reported are in excess of the total number of accidents, due to the fact that many accidents result from a combination of causes.

Accidents Involving Two or More Vehicles Showing Course Pursued

Type of Accident Course Being Pursued	Number of Lanes									
	Two		Three		Four		Miscl.		Total	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
Overtaking	1049	27.15	298	34.33	179	39.34	29	27.88	1555	29.39
Approaching	1795	46.46	287	33.06	95	20.88	36	34.62	2213	41.83
Paths Intersecting (On same road)	548	14.18	170	19.59	87	19.12	24	23.08	829	15.67
Paths Intersecting (On different roads)	431	11.15	98	11.29	79	17.36	11	10.58	619	11.70
Undetermined	41	1.06	15	1.73	15	3.30	4	3.84	75	1.41
Total	3864	100	868	100	455	100	104	100	5291	100
Per cent		73.03		16.41		8.60		1.96		100

cles are involved in an accident the contributing causes are more numerous and complex. For the 5291 separate accidents of this type, 7112 causes were reported as contributing factors. Although a very great variety of causes go to make up this total, a comparatively few specific types account for the bulk of all causes reported.

"Driver intoxicated or had been drinking" appears 1133 times or 16 per cent; "improper passing" 1074 times or 15 per cent; "Speed excessive for conditions" 912 times or 13 per cent; "On wrong side of road, as distinct from improper passing" 506 times or 7 per cent; "Improper turn" 480 times or 7 per cent; "Following too closely" 489 times or 7 per cent; and "Improper signal" 321 times or 5 per cent. These seven items represent 70 per cent of all causes reported, the remaining 30 per cent being split up into a multitude of various items, no single one of which accounted for any important percentage of the total.

Again comparing the record for the first six months' period we find that the pattern remains much the same throughout the year. Computed on the same basis of percentage of total causes reported, the first six months' period record was: "Driver intoxicated or had been drinking" 15 per cent; "Improper passing" 17 per cent; "Speed excessive for conditions" 11 per cent; "On wrong side of road as distinct from improper passing" 7 per cent; "Improper turn" 7 per cent; "Following too closely" 8 per cent; and "Improper signal" 9 per cent.

The elimination of the causes found in these main groups, which go to make up such a large majority of all causes reported, would seem to lie principally in regulatory, or a combination of educational and regulatory, measures.

For the full year the accidents in which pedestrians were involved amounted to 6.64 per cent of all accidents reported. This compares with a percentage of 6.39 for the first six months' period. Such accidents rarely involve more than a single motor vehicle.

ACCIDENT FREQUENCY

Evidence of drinking on the part of the pedestrian was reported in 24 per cent of the cases, showing little change from the 25 per cent recorded for the first six months' period. Since there are comparatively few intersections on rural highways, pedestrian accidents occurring at such points were only 7 per cent of the total. The vast majority (74 per cent) involved persons walking on or along the highway or attempting to cross at places other than at intersections. Eight instances were reported where "children playing in road" were involved, but the victims of pedestrian accidents are almost invariably adults who should be aware of the dangers but who forget or fail to realize the extreme caution necessary on their part, particularly on rural highways where pedestrian traffic is rare and presents an unexpected situation to the motorist.

Vehicle-miles-per-accident is the true measure of the hazard of motor vehicle operation. As noted above, during the year 1936, 7665 motor vehicle accidents were reported as having occurred on the rural portion of the State highway system. The estimated total vehicle miles of travel during this same period on the rural State highways were approximately 7,211,000,000. This estimate is based on the regular summer traffic count taken at more than 1300 points over the entire system, and supplemented for the determination of seasonal changes by some 40 carefully selected points throughout the State at which counts are taken each month during the year.

From these figures it is seen that the ratio of accidents to vehicle miles traveled is 1 to 941,000. The corresponding ratio for the first six months' period was 1,061,000, indicating, as was previously stated, that the accident rate has been more serious during the latter half of the year. This change has not been confined to any type of accident, cause, or location. There have been slight variations back and forth but comparative percentages have remained much the same.

Of the rural State highways, 99 per cent are either two-lane, three-lane, or four-lane; in fact, over 94 per cent are two-lane roads.

ACCIDENT COMPARISONS

An endeavor has been made to indicate certain relationships between accident frequency and roadways of the different lane widths on the basis of "Accidents per mile of highway," "Vehicle miles per accident," and "Density of traffic" or "Proportionate utilization of road capacity." While the number of vehicle-miles-per-accident is a definite measure of the actual hazard of motor vehicle travel, no accurate comparison of

functional value as among various types of roads can be made without taking into consideration to what proportion of their rated capacities such roads are actually operated.

It is immediately apparent that when taken as a group the two-lane roads will show the lowest rate of accidents per mile of road, due to the many thousands of miles where there is comparatively little traffic. Likewise, three-lane roads show less concentration of accidents than the four-lane. The rates of accident concentration per mile are respectively: 0.484, 2.625, and 4.215.

Compared on the basis of vehicle-miles-per-accident, the two-lane roads also show a better record but on this basis of actual hazard the advantage is slight, even though the same situation still remains: that of having a relatively low average number of vehicles per day over these two-lane roads.

STATISTICAL COMPARISON

The number of vehicle-miles-per-accident were 991,000 for two-lane, roads, 851,000 for three-lane, and 717,000 for four-lane, while the corresponding numbers of vehicles for an average 24-hour day were 1236 for two-lane; 6533 for three-lane; and 8771 for four-lane. These extreme differences between average daily traffic on two-, three-, and four-lane roads can be accounted for only to a limited extent by the traffic capacities of the various lane widths.

The two-lane road has been estimated to have a capacity, under average conditions, of 1000 vehicles per hour; while the three-lane road, with only one-half more lanes, has been treated as having twice the capacity of the two-lane, or 2000 vehicles per hour; and the four-lane road, with twice the number of lanes found on the two-lane road, has been rated at 3.2 times the capacity, or 3200 vehicles per hour.

Even on these capacity bases it is found that the two-lane roads as a group utilize only 5.46 per cent of their 1000 vehicles-per-hour capacity, while the three-lane roads use 12.72 per cent of their 2000 vehicles capacity, and the four-lane roads 10.75 per cent of a 3200 vehicles-per-hour rated capacity. The comparatively small difference between two-lane and three-lane roads in the vehicle-miles-per-accident rate becomes even less important when it is disclosed that traffic on two-lane roads would have to be increased to two and one-third times its present volume to reach a point where they would be utilizing the same relative percentage of capacity as that now found on three-lane roads. The ratio of capacity use between two-lane and four-lane roads is approximately 1 to 2.

THREE-LANE ACCIDENTS

In view of the rather widely discussed question of traffic accidents on three-lane roads, it is interesting to further analyze this situation so far as it concerns the records on the rural State highways in California for the past year. When accidents involving a single motor vehicle are considered separately, the question of traffic is of minor importance. In this type of accidents we find the vehicle-miles-per-accident rate for three-lane roads is much better than for two-lane, being 3,827,000 miles per accident for the three-lane as against 2,968,000 miles per accident for the two-lane. This is probably due to the fact that the three-lane highway is wider and of higher average standard in surface, grade, and alignment.

Accidents where two or more vehicles are involved, taken as a group, show a better vehicle-miles-per-accident record for the two-lane than for the three-lane, the rates being respectively 1,719,000 and 1,411,000. If no further inspection were made the conclusion might be made that the three-lane design was inherently less safe than a two-lane and tended to encourage accidents. If the provision of a third lane could adversely affect traffic safety, it would appear that such influence would be confined to accidents between approaching vehicles—in other words, to some type of head-on collision. It has already been pointed out that the ratio of "Approaching" accidents to the total of all accidents on three-lane roads is less than the similar ratio on two-lane roads.

THREE LANES HAVE ADVANTAGE

If we compare further the actual number of "Approaching" accidents on three-lane roads and on two-lane roads with the total vehicle miles generated on the two road types, we find that there was one "Approaching" accident on three-lane roads for every 3,280,000 vehicle miles, while the corresponding rate on the two-lane was one for every 3,198,000 vehicle miles: practically the same rate but with whatever slight advantage there is being in favor of the three lanes. And this advantage accrues to the three-lane road group in spite of the fact that no allowance has been made for the very great disadvantage it must overcome in carrying nearly five times as much actual average daily traffic, or two and one-third times as much if compared on basis of capacity.

"Overtaking" or rear-end accidents and "Paths intersecting while traveling the same road" (mostly made up of left-turn accidents) occur somewhat more frequently on the three-lane than on the two-lane roads. Road intersection accidents account for practically the same percentage on both types of roads.

It can scarcely be argued that the fact that a third lane has been provided could be the cause for an increase in the number of either "rear-end" or "left-turn" accidents. On the contrary, it is quite likely that this added width has made it possible for numerous drivers to avoid impending rear-end and left-turn accidents.

INCREASED LANES SOUND

The full year's record of accidents continues to add weight to conclusions to be drawn from the record shown in the first six months' period: that from the standpoint of safety the present method of meeting traffic development by adding an additional lane to the existing two-lane pavements is basically sound.

On four-lane roads "Approaching" accidents were shown to be 21 per cent of the total on this type of road. In actual numbers there were 95 such accidents reported, or one for every 4,740,000 vehicle miles. This is a much better rate than for either the two-lane or the three-lane, but is much less than could reasonably be expected when two lanes have been provided for traffic in each direction. It indicates flagrant disregard of right of way on the part of a large percentage of the traffic.

"Overtaking" or rear-end accidents are more frequent on four-lane than on either two- or three-lane roads. This is true both in percentage and on actual vehicle-miles-per-accident basis. In comparison with three-lane roads, this does not even have the support of a larger ratio of capacity utilization, for the three-lane roads are

Accidents by Lane Widths Showing Road and Vehicle Mileage

ACCIDENTS INVOLVING A SINGLE VEHICLE

Number of Lanes	Road Mileage	Per cent	Total Accidents	Accidents per Mi.	Thousand Vehicle Miles	Per cent	Thous. V. M. per Acci-dent	Avg. No. Vehicles per 24-hr. Day	Rated Capacity Veh. per Day	Per cent of Capacity Util-ized
2	11,969.0	94.36	1936	0.162	5,740,577	79.61	2968	1310	24,000	5.46
3	421.3	3.32	246	0.584	941,391	13.05	3827	6105	48,000	12.72
4	149.0	1.17	152	1.020	450,376	6.25	2963	8259	76,800	10.75
Miscl. Widths	145.6	1.15	13	0.089	78,759	1.09	6058	1478	-----	----
Location of Acci-dent not known	----	----	27	----	----	----	----	----	-----	----
Total	12,684.9	100	2374	0.187	7,211,030	100	3038	1553	-----	----

ACCIDENTS INVOLVING TWO OR MORE VEHICLES

2	11,969.0	94.36	3856	0.322	5,740,577	79.61	1489	1310	24,000	5.46
3	421.3	3.32	860	2.041	941,391	13.05	1095	6105	48,000	12.72
4	149.0	1.17	476	3.195	450,376	6.25	946	8259	76,800	10.75
Miscl. Widths	145.6	1.15	29	0.199	78,759	1.09	2716	1478	-----	----
Location of Acci-dent not known	----	----	70	----	----	----	----	----	-----	----
Total	12,684.9	100	5291	0.417	7,211,030	100	1363	1553	-----	----

ALL ACCIDENTS

2	11,969.0	94.36	5792	0.484	5,740,577	79.61	991	1310	24,000	5.46
3	421.3	3.32	1106	2.625	941,391	13.05	851	6105	48,000	12.72
4	149.0	1.17	628	4.215	450,376	6.25	717	8259	76,800	10.75
Miscl. Widths	145.6	1.15	42	0.288	78,759	1.09	1875	1478	-----	----
Location of Acci-dent not known	----	----	97	----	----	----	----	----	-----	----
Total	12,684.9	100	7665	0.604	7,211,030	100	941	1553	-----	----

operated on an average at 12.72 per cent of their capacity, compared with 10.75 per cent for the four-lane.

CROSSING HAZARDS

Accidents occurring when the paths of vehicles intersect while traveling the same road, made up chiefly of left-turn movements, are of only slightly greater frequency on the four-lane than on the three-lane roads; but in those that result from conflict of right of way at road intersections the percentage for the four-lane roads is quite definitely higher. This is the natural result of the hazard of crossing several lanes of traffic and also because the four-lane roads are found in the more densely populated areas, where road intersections occur at comparatively short intervals.

Theoretically, if the four-lane road were divided into two one-way roads of two lanes each, the approaching accidents should disappear altogether. Practically this would not be 100 per cent true, for there would always be the occasional driver who would run by his destination or intersecting road and insist on turning around and making his way back against approaching traffic. But even if the 21 per cent of approaching accidents were entirely eliminated, the vehicle-miles-per-accident rate would still be unsatisfactory when considered in the light of the excellence of facilities which are provided for safe travel, with two lanes of roadway in each direction and the high standards of surface, grade, and alignment which are found on the four-lane highways.

SPECIAL STUDIES MADE

The total mileage is comparatively small and is made up of many short stretches in widely scattered areas. Under such circumstances general statements are very likely to be misleading unless hedged about by qualifications, and for this reason special studies are being made of particular sections of these highways.

In order to present a more concrete view of the general accident situation, the various small administrative units of the rural State highways—sections that average approximately ten miles each—were classified both for concentration of accidents, or "accidents per mile," and for hazard of accident, or "vehicle-miles-per accident." Those with the poorest records in both groups were combined, with the result showing that over 46 per cent of the accidents were reported on less than 7 per cent of the road mileage. Still further concentration shows 17 per cent of total accidents on approximately 2 per cent of the mileage. It is particularly noteworthy that the highway sections in these groups in nearly every instance represent the highest standards of construction and maintenance.

Disconcerting as many of these records may be, it is only by the exact establishment of the pertinent facts for intelligent study that it becomes possible to outline a course of action with any reasonable hope of solving this vital problem of safety on our highways. Additional detailed tabulations on which this article is based may be obtained by writing to the editor of California Highways and Public Works, Sacramento.

How U. S. and State Routes Are Designated by Numbered Markers

By F. M. CARTER, Assistant Maintenance Engineer

AMONG the highway signs used by the California Division of Highways for the protection and convenience of motorists on State roads are those which come under the classification of "Guide Group." This group covers Route Markers, Destination, Location and Information signs and in this, the fourth of a series of articles on highway signs, discussion will be confined to Route Markers.

Guide signs are used to furnish the traveler with directional and locational information.

U. S. Highways and main State through highways are indicated by numbered route markers. The same general system of marking is used for both the U. S. and the State highway numbered systems. The outline of the official shield of the United States is used in all states for numbering U. S. highways.

DIRECT ROUTES FOLLOWED

These U. S. Highway numbers are selected by the Executive Committee of the American Association of State Highway Officials, through the authority vested in them by the government. The procedure followed by this Committee is to adopt the most direct routes through the various states where State highways are available.

It is imperative that a U. S. numbered highway shall at all times be in the best possible condition, and because of this the route follows State highways which assure the best of maintenance for traveling.

The present policy of the Committee is to eliminate all duplicate routings, to reduce the number of alternate routings, and to hold such highways to the least possible number consistent with proper guidance.

METHOD OF SELECTION

The procedure, when a new numbered highway is proposed by interested committees and public bodies, is for the Association of State Highway Officials to refer to each State that portion of the proposed route traversing the state.

When the routing has been approved as to each State and by the necessary governmental units the matter is then decided by the executive committee of the A. S. O. S. H. If such decision is favorable, the number is designated and the executive secretary issues the description of the approved route and the signs are placed by the various States traversed by that route. A gridwork of numbered U. S. highways has resulted from this procedure until practically all available routes are so designated and numbered.

NEW ROUTES NOT WANTED

The tendency now is to discourage any additions to this U. S. numbered highway system.

In selecting numbers for these U. S. routes the general policy was to start from the northern part of the United States with the smallest even number for the east and west routes and from the eastern (Atlantic Coast) part with the smallest odd number for the north and south routes. The numbers then increase consecutively from north to south and from east to west.

In the U. S. numbered highways, while the numbers may conform to the above method at the origin of the route in the east, they may be out of sequence when reaching California. For the most part, however, the system conforms to the above outlined method.

In California, for instance, considering the east-west routes and starting at the most northerly, we find the U. S. numbered highways are as follows:

40–50–66–60–70–80

Starting at the eastern border of the state, we find on the north-south routes:

91–395–97–99–101

In addition to the number 395 we find 399–299 and 199 for the odd numbered routes, and 466 for the even numbered routes.

These higher numbers are selected to designate routes of a much shorter length starting from one of the regular highways, taking the last two numbers from the highway of origin, and adding another number, which shows the approximate location of the highway in the state or states.

SYSTEM IN THIS STATE

Using the original system for numbering U. S. highways, the State of California, through the Division of Highways, has numbered the through State highways. The even numbers are on the east-west routes, and the odd numbers designate the north-south routes. The numbers are alternated between the north and the south so that each section may have low numbers.

The State highway route numbers for signing should not be confused with the legal highway numbers designated by legislative action and used for departmental and legal purposes.

A numbered sign route sometimes covers many different numbered highways in traversing from one part of the state to the other. It is necessary in obtaining through information for the traveler to carry the sign numbers as far as possible. Practically all of these important State highway numbered routes are now signed and the various information maps show these routes by number. With this information, the traveler can plan his journey before leaving his origin and, through the easy way of following numbered shields, arrive at his destination with the least possible confusion and delay.

The marker or shield used for the State numbered route system is in the shape of an acorn, with the California Bear at the top and the words, "State Highway" across the bottom of the shield.

(Continued on page 17)

"Guide" Group of California Road Sign System



Placed in advance of an intersection where two U. S. or State highways meet or are coincident.



On same post with U. S. or State shield. Indicates routing temporary.



Placed above U. S. or State shield to mark a detour on closed route.



Standard marker used to define U. S. highways. Placed at frequent intervals in rural areas and cities to guide traffic over U. S. routes.



New Identification Directional Sign to be placed in advance of important intersections of numbered highways. This directs traffic straight ahead or to right.



Indicates business route through city for motorists desiring to use it.



This prominent sign is placed approximately 300 feet in advance of an intersection where four U. S. or State numbered routes meet or are coincident.



This new sign is the same as above except that traffic is directed either to the right or the left.



Placed above U. S. shields to designate an alternate route.



Indicates designated route may be followed by going straight ahead or turning to the right.



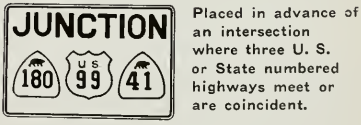
Standard marker to define U. S. highways. Is reflectorized.



Standard shield used to mark State sign routes. Placed at frequent intervals in cities and rural areas along a State sign route.



Right or left arrow used with U. S. or State shields to indicate a turn or proper direction of the route.



Placed in advance of an intersection where three U. S. or State numbered highways meet or are coincident.



Indicates designated route may be followed by going ahead or turning to the left.



Placed approximately 300 feet in advance of intersection with a U. S. or State numbered highway.



Used with U. S. shields or State markers to indicate that traffic may turn either right or left to follow marked highway.



Same as standard shield on State sign routes but is reflectorized.



Placed approximately 300 feet in advance of the end of either a U. S. or State numbered highway.



Used with U. S. or State shields to direct traffic straight ahead.

Figueroa Street Viaduct Project in Los An



Center span is 200 feet long, one of the largest plate girder spans in the country. The other steel spans are 104 an

By PAUL R. WATSON, Resident Engineer

FOR many years the city of Los Angeles has felt the need of an additional through traffic highway to the north to relieve congestion on North Broadway. Figueroa Street, one of the main north and south arterials in the city, was the logical street to be extended. A barrier formed by the Elysian Park hills and the Los Angeles River made this undertaking very expensive. However, the project has been carried forward one step at a time as funds became available.

The first step was taken in 1928 when plans were ordered for the first tunnel under Elysian Park. The final or fourth tunnel under the Elysian hills was recently completed. The final barrier is the Los Angeles River and the Southern Pacific tracks over which the Figueroa Street Viaduct is now being constructed.

VIADUCT COST $625,000

This viaduct is nearing completion. The viaduct project is the largest one in the southern part of the State to be financed from funds set aside by the Federal Government for grade crossing elimination. It is being constructed under the supervision of the Bridge Department, of the State Division of Highways. Plans for the structure were prepared jointly by the bridge engineers of the city of Los Angeles and the State. The work when completed will cost $625,000.



View of section of the Figueroa Street Viaduc

es Crosses 2 Railroads, River and Highway



eet respectively. Reinforced concrete spans are supported by girders 4 feet thick at center and 7 feet at haunches.



g the massiveness of the reinforced concrete
n.

The structure is a northerly extension of Figueroa Street on a direct line with the four tunnels under Elysian Park hills. It crosses the tracks of the Southern Pacific Railroad which occupy both banks of the Los Angeles River. It also crosses the Los Angeles River, San Fernando Road, and the street car tracks of the Los Angeles Railway Company on said road.

The project includes the construction of the viaduct proper; the construction of 850 feet of roadway embankment and pavement to make connection with Figueroa Street at Avenue 22, north of the river; the building of a retaining wall along the embankment on the westerly side of the approach; the construction of 700 lineal feet of slope paving along the westerly bank of the Arroyo Seco, and the construction of a southerly connection to the tunnel road under Elysian Park.

PUBLIC UTILITIES RELOCATED

In connection with the construction of the viaduct pier footings, it was necessary to relocate a large sewer pipe which parallels the structure, relocate various public utilities on San Fernando Road, and to temporarily relocate various tracks of the Southern Pacific Railroad which interfered with the foundation work.

The northerly approach to the viaduct is 74 feet wide between curbs, with 5-foot sidewalks on both sides. The width of the structure is 44 feet between curbs, plus sidewalks.

The viaduct consists of five continuous reinforced concrete girder spans, and three continuous steel plate girder spans, all resting on concrete

(Continued on page 27)

Honors Conferred on C. H. Purcell the Man Who Built Bay Bridge

IN RECOGNITION of his work as Chief Engineer of the San Francisco-Oakland Bay Bridge, State Highway Engineer C. H. Purcell was given an honorary degree of Doctor of Laws by the University of California at the Charter Day exercises held in Berkeley on March 23.

Mr. Purcell was presented by Professor Charles Derleth, Jr., chairman of the Department of Civil Engineering at the university. In conferring the degree, President Robert Gordon Sproul characterized Mr. Purcell as a "resourceful public servant; organizer and leader of men; builder of great bridges and highways; an engineer who has bound together with bands of steel the citizenry of a great commonwealth which expanse of water had previously divided."

HONORED BY ALMA MATER

Mr. Purcell previously had been honored by his alma mater, the University of Nebraska, which on June 10, 1935, conferred upon him the honorary degree of Doctor of Engineering, the highest honor bestowed by universities upon men pre-eminent in the field of engineering.

Further tribute was paid to Mr. Purcell on Wednesday evening, April 7, when more than one hundred friends tendered him a dinner at the Palace Hotel in San Francisco. Governor Frank F. Merriam, Dean Harry F. Grady and Harrison S. Robinson were the principal speakers. Seated at the speakers' table were Director of Public Works Earl Lee Kelly, Alfred J. Cleary, Chief Administrative Officer of San Francisco, representing Mayor Angelo J. Rossi, who was ill; and City Attorney John J. O'Toole.

The committee in charge of the dinner was composed of W. N. Burkhardt, George T. Cameron, Leland W. Cutler, Sidney M. Ehrman, Joseph R. Knowland, Clarence Lindner, Daniel J. Murphy and Harrison S. Robinson.

Born in North Bend, Nebraska, January 27, 1883, Mr. Purcell attended Stanford University for one year in 1902. The death of his father called him to Chicago where he remained for twelve months and then entered the University of Nebraska, graduating as a civil engineer in 1906.

BUILT OREGON BRIDGES

Mr. Purcell built his first bridge across Bitter Creek in Wyoming where he was a resident engineer for the Union Pacific. He later had engineering experience in Nevada, South America and Oregon. He was the first bridge engineer for the Oregon State Highway Department, Assistant State Highway Engineer of Oregon and bridge engineer of the Columbia River Highway.

After several years as a bridge engineer with the U. S. Bureau of Public Roads, Mr. Purcell was appointed State Highway Engineer of California in 1928.

In October, 1929, the Hoover-Young San Francisco-Oakland Bay Bridge Commission was created and Mr. Purcell became a member of it and its secretary. He was authorized to make an investigation, traffic survey and prepare a preliminary plan and design, including financing, for a bridge across San Francisco Bay.

Mr. Purcell's completed report was adopted by the commission and in January, 1931, he was named chief engineer for the Bay Bridge, continuing to administer the duties of his office as State Highway Engineer.

All Californians are familiar with the financial delays and difficulties encountered by Mr. Purcell, the State Administration and the Department of Public Works in obtaining through Congress and the Reconstruction Finance Corporation the funds necessary for the building of the bridge. However, these funds were obtained, largely through Mr. Purcell's efforts in Washington, and the Stanford freshman who had worked as a messenger boy in the Chicago Grain Pit began the stupendous task of bridging San Francisco Bay.

True Builder Is Honored

In every great construction project there always is to be found one man on whom the final authority falls, who bears the ultimate responsibility for the undertaking.

In the building of the San Francisco-Oakland Bay Bridge —the greatest bridge ever constructed—that one man was Charles H. Purcell, who stepped from the routine and moderately compensated desk of highway engineer to carry on modestly, successfully, the great job of spanning the bay.

Recently the University of California honored itself by granting a degree to Mr. Purcell, making him one of the university's alumni.

More recently the recognition of a public banquet in honor of the bridge builder was given here. Citizens high in public and civil life paid their tribute to the man who by his achievement may well be considered first in his profession.

Only engineers can realize the task which Mr. Purcell met and conquered; but all who leap over the bay on the strong, perfect causeway instinctively feel grateful to the builder, and it is appropriate that he is receiving recognition for his job well done.—*San Francisco Examiner.*

Payments of special fees and taxes by motor car owners in the United States last year reached $1,400,000,000, the greatest total ever reached for a single year, according to a preliminary report received by the California State Automobile Association.

How U. S. and State Routes Are Designated by Numbered Markers

(Continued from page 12)

In conjunction with these shields the left, right, and double pointed arrows and the junction signs complete the information and guidance for the motorist.

The positioning of these shields and markers is uniform for both the U. S. and State numbered highways and unlike the warning group of signs these guide signs should be frequently and judiciously placed with the policy of having what may seem too many rather than too few shields.

AID TO STRANGERS

It must be remembered that the signing of these numbered routes is for the stranger to the locality and not for the local citizens who know all the short cuts and best routes. To obtain the proper impression such as is received by the stranger it is only necessary for the local citizen to travel in unfamiliar sections of our State or in other States. He will then appreciate these numbered routes with frequent shields and markers.

The shields are placed at all major intersections in urban areas, at every other block in residential areas and, in the open country, at intersections, if there be any, otherwise at intervals of three miles.

The shields and markers must be placed so as to be readily seen by the motorist. On routes through rural districts they should be placed not less than 8 nor more than 10 feet from the edge of pavement on the right hand side, and 3 feet 6 inches above the pavement. If two or more shields or markers are used on the same post, the lowest shield or marker should not be lower than 2 feet above the pavement.

USE OF ARROWS

Turn arrows are placed in advance of and at the near corner of all turns of the route and double pointed arrows in connection with the numbered shield facing traffic entering the numbered route at important intersections advise the motorist that he has arrived at the point of entering the route.

When coincident routes approach an intersection where one route turns and the other proceeds the usual advance turn arrow is placed and at the near corner of the intersection the turn arrow, with shield for the turning route and the vertical arrow with shield for the continuing route give the necessary guidance. When one numbered route crosses or joins another route, junction signs are placed facing the approaching traffic, giving number of route intercepting or joining the route being traveled.

TEMPORARY SIGNS

When two numbered routes run on the same highway, the two numbered shields are placed on the same post. In some cases numbered routes are carried temporarily over other than the designated route because of unconstructed portions of the regular highway. Plates with the word "Temporary," are placed over the numbered shield on such temporary routes.

When the same numbered route separates to come together again at a point farther on, an alternate plate is placed over the shield. These alternate routes were originally marked E and W, or N and S. But a recent ruling of the A.S.O.S.H. executive committee changed this designation, making one the main numbered route, and the other the alternate route.

The most direct, easiest, and quickest traveled highway is designated as the main numbered route, and the other highway as the alternate.

Sometimes in metropolitan areas, when the numbered highway does not pass through the central business area, a numbered route with the plate "Business Route," placed over the shield on the same post, is carried from the main route through the central business district and back to the main numbered route.

When it becomes necessary to detour a numbered highway, shields with the plate "Detour" should be placed along such detours at much more frequent intervals than on the regular route.

"Say, porter, did you find a big roll of money under my pillow?"

"Yessuh. I did, suh, and I thanks you, suh, very much, suh."

New Los Gatos-Santa Cruz Highway Saves Five Miles

(Continued from page 2)

clothed with redwood; and, because of the plant growth, the soil, instead of eroding as usual, accumulates on the slopes, forming a deep, damp mantle of loam on the porous granite base. While this makes a wonderful seed bed, it is an extremely treacherous foundation for a heavy fill.

Borings and trenches disclosed that there was an underground sheet of water moving on top of the granite, and it was decided to attack this problem in a thoroughgoing manner. Therefore, on most of the larger fills, practically the entire earth blanket was stripped to bedrock and an imported rock blanket was substituted as a fill base, to provide free drainage and prevent saturation of the fill. Also, heavy rock toe walls were constructed at the lower sides of fills to prevent, as far as possible, the entire fill from taking a toboggan ride down the steep canyon slopes. Deep trenches were dug into the rock across the fill base and above the upper slopes of the fills to concentrate and cut off as much water as possible.

A minor problem was to provide driveway approaches to the numerous suburban homes along the route, some of them high above the grade of the roadbed and others far below it.

The length of this project was 3.93 miles, and the cost was $252,692.

Highway Crew Catch Two Gasoline Thieves

During the last two months, considerable quantities of motor fuel have been drained from tanks of tractors and other equipment in use by Highway Superintendent B. M. Gallagher on the Maricopa and Casitas Pass roads. The thievery was always committed at night.

Early in the morning of March 24, three of Superintendent Gallagher's crew caught two men in the act of draining gas from a Division of Highways tractor. The pair was taken to Ventura jail where they confessed to six different counts of gasoline theft and in the afternoon received their sentences.

Surfacing Improvements on East of Sierra Highway

By C. CLEMAN, District Maintenance Engineer

TOURISTS and sportsmen motoring into picturesque Mono County this summer will find greatly improved roads for pleasure trips through the Mono Lake and Walker Canyon areas which afford delightful scenic views and abound in fish and game.

Better economic conditions throughout the country have resulted in an increase of recreational traffic with a consequent influx of fishermen, hunters, tourists and vacationists into the many attractive summer resort and camping sections in the Sierra Nevada Mountains.

Highway improvement by stage construction has been going on for several years in the eastern Sierra range country north of Bishop. The Division of Highways has completed several reprocessing projects on roads in Inyo and Mono counties with the result that motor travel in those regions this summer will be greatly facilitated.

U. S. 395 IMPROVED

The allocation of additional betterment funds in 1936 permitted the improving of various sections of bituminous treated surfaces which required immediate attention in order to improve the riding quality and forestall reconstruction on certain stretches where money would not be available for reconstruction in the near future.

A number of sections of U. S. Highway No. 395 in Mono and Inyo have been improved. Between Conway Summit and Mono Inn, 6.7 miles of low type dust oiled surfacing was reprocessed, additional oil applied to the material and later sealed. The same method of improvement was used on portions of the Walker River Canyon road between Bridgeport and Coleville.

A class "A" seal coat was applied, not only to the reprocessed sections of U. S. Highway No. 395 in Mono County, but also to those sections which showed surface leakage or ravel. Permeability tests were made at definite intervals and the locations recorded where the surfacing showed leakage, signs of ravel, pavement cracks, etc. The seal coat was applied by the A. S. Vinnell Company, under contract with A. P. McCarton as Resident Engineer, for a total net distance of 46.7 miles between Convict Creek and Antelope Valley in Mono County. Approximately 0.15 gallons per square yard Type MC-3 liquid asphalt and an average of 11 pounds of screenings were applied.

BEAUTIFUL SCENERY

The oil cake on the section between Conway Summit and Mono Inn was widened from 16 to 18 feet. The view along a section from Conway grade is undoubtedly one of the most spectacular in this part of the country. The changing colors reflected from the waters of the lake are an inspiring sight even to the local residents who have had an opportunity to look at it many, many times. Beyond the lake the famous snow capped Mono craters can be clearly seen.

The westerly portion of State Route 40, between Leevining and Benton, traverses the south lake shore and then disappears in the wooden section near Mono Mills. The floor of the valley in the foreground comprises the Conway Ranch, after which this section of road has been named. The Sierra Nevada Mountains rise high in the background to complete this inspiring view. Traveling southerly approximately 7 miles from this point, the highway skirts the westerly edge of Mono Lake.

ROAD REPROCESSED

The highway along the water's edge of Mono Lake was constructed by the Isbell Construction Company in 1934, under Contract 69VCI, M. W. Ellis, Resident Engineer. This is a standard 24-foot graded roadbed, surfaced the full width with selected material, having a compacted thickness of 0.25 of a foot, of which the central 20 feet was bituminous treated by the road mix method. An application of $\frac{3}{8}$ gallon per square yard of light fuel oil was spread upon the subgrade as a tack coat. The bituminous binder considered as asphaltic road oil cutback with 18% kerosene solvent and applied at an average rate of 2.1 gallons per square yard. The mixing units consisted of two 10-foot blades, towed by 60-h.p. tractors.

These units made repeated turnings of the material until a complete mixture of oil and aggregate of uniform texture and free from compressed masses had been obtained. The mixed material was spread in thin layers with a pneumatic tired power grader. Continuous blading and rolling were necessary to acquire the smooth and even surface obtained.

RAVELING PREVENTED

A rubble masonry retaining wall has been constructed at the base of raveling cut slopes to prevent loose rock and slough deposits encroaching upon the traveled way. These walls have greatly decreased the cost of maintenance by reducing daily patrolling by a Maintenance Foreman or maintenance crew. The average actual cost of this type wall is approximately $3 per lineal foot. Instead of the material depositing upon the roadbed, it is retained behind the wall, which is removed periodically as required.

Another scenic section of highway parallels the West Walker River, in what is commonly known as the West Walker River Canyon, an attractive spot for fishermen and tourists, was graded to a 24-foot standard section in 1931. An inspection of this section during 1936 disclosed that slight leakage occurred and some shoulder ravel. Approximately $2\frac{1}{2}$ miles of this section was reprocessed last fall and a Class "A" seal coat applied.



Three views of newly reprocessed highways leading to recreational areas in Mono County. Upper: New alignment along shore of Mono Lake. Center: View from Conway Grade looking over Mono Lake with Mono craters in background. Lower: Looking into Long Valley from Sherwin Grade, north of Bishop, with snow-covered Sierra in background.

Building Divided Highway Link on L. A.-Pomona Airline Lateral

(Continued from page 4)

line highway was available with a saving of three miles over any previous existing route.

Within a few months this super-safety boulevard had become a crowded four-lane highway from Los Angeles to Monterey Park and a hazardous overloaded three-lane road between Monterey Park and Pomona.

Without benefit of publicity the Los Angeles-Pomona Lateral became almost immediately the southland's most cosmopolitan artery. Heavy out-of-state tourist travel, pleasure seeking motorists bound for the all-year resorts in the San Bernardino mountains, an ever increasing tide of commuters together with slow moving, heavily laden motor transports from the southwestern United States and produce from the Imperial Valley, combined to create a traffic volume of 14,435 vehicles during the July 14, 1935, traffic count taken on the 30-foot pavement between El Monte and Monterey Park.

Traffic census figures for July 12, 1936, taken at the same location showed an increase to 18,271 vehicles.

WIDENING NECESSARY

During the current winter season heavy travel to the very popular desert resorts and increased out-of-state winter tourists raised the total Saturday and Sunday volume of traffic, on the 30-foot pavement to above 40,000 vehicles. Not only was the highway overcrowded but the variety of speeds employed by the different types of vehicles made it doubly hazardous.

On July 10, 1936, or fifteen months after the opening of the highway between Los Angeles and Pomona, the State Highway Commission allocated the sum of $342,000 for the purpose of widening the existing 30-foot Portland cement concrete pavement to 40 feet between Monterey Park and Pomona, a distance of 18.7 miles and the placing of plant-mixed surfacing on the shoulders from the westerly end of the project to the west slope of the Kellogg hills.

Plans were rushed to completion and in September, 1936, a contract was awarded to the successful bidder, Griffith Company of Los Angeles. The contract was amended in November of that year and a supplemental allotment of funds in the amount of $55,000 was made for the purpose of providing a separated roadway for six miles through the Kellogg Hills to Pomona.

The contract as amended now consists of the placing of two 5-foot wide strips of Portland cement concrete with 8-foot wide plant-mix shoulders on both sides of the existing pavement on Garvey Avenue from Monterey Park to Valley Boulevard.

From Valley Boulevard to the east end of the contract at Pomona, the existing pavement will be widened to 40 feet by constructing a single 10-foot wide strip of Portland cement concrete, while the adjacent graded shoulder is to be surfaced with an 8-foot width of plant-mix to the west slope of Kellogg hills. On the easterly 6.3 miles of the contract through the Kellogg hills to the City of Pomona, the pavement will be completed to 46-foot width.

WORK NEARS COMPLETION

The contractor, though hampered considerably by rains and cold weather, has made excellent progress. All concrete pavement was placed by April 1st, and the work will be completed by May 15.

The purpose of the 46-foot pavement is to provide width in order to separate opposing lines of traffic by placing a 4-foot wide raised bituminous strip in the center of the pavement, creating a 21-foot lane for traffic in each direction separated by the 4-foot raised strip feathered at the edge to meet the pavement.

This improvement will separate the roadways and prevent traffic from crossing over to the opposing lane, but it will not present any serious obstacle that might cause damage to a vehicle in case it encounters the dividing strip.

The dividing of the westerly end of the Los Angeles-Pomona Lateral is in keeping with the State's desire to build safe highways.

Motorists Give Aid to Highway Planning Survey

THE Division of Highways of the State Department of Public Works, with the cooperation of the Bureau of Public Roads, has recently mailed to a large sample of the State's motor vehicle registration a questionnaire post card asking for data on residence of owner, make and year of vehicle, travel during a 12-months' period, average gasoline consumption, and fees paid.

The study is a phase of the Statewide Highway Planning Survey, which has been in progress for several months, and the several correlated features of which have been designed to yield information which should prove of great value to highway officials attempting to plan in the interest of the motoring public a program of highway operations for a considerable future period.

Questions relating to Motor Vehicle registration and license fees are included to facilitate arriving at actual comparisons between contributions for highway purposes received from urban residents and those received from rural residents. As explained on the card, there is no way of identifying an individual vehicle owner with the information received, no postage is required in returning the questionnaire portion, and the returns are for the Planning Survey's exclusive use.

MANY MOTORISTS RESPOND

The mailing of the cards from Sacramento started on March 19th and thousands of well executed responses have already been received. Planning Survey officials are hopeful of a particularly high percentage of returned cards. Vehicle owners who receive cards have been asked to use particular care in answering Question One, which has for its objective the accurate fixing of the vehicle ownership by county and by rural areas and particular urban places in the various population groups. This has been given as the most important part of the questionnaire.

Responders are asked to make some attempt at answering questions that cover miles traveled and average gasoline consumption.

Ladies Get Free Auto Service on Trans-Bay Span

LADIES are preferred patrons of the San Francisco-Oakland Bay Bridge. Chivalric treatment of the fair sex is part of the code of the bridge maintenance crew. Should a woman motorist have tire trouble on her trip across the span, the maintenance men will service her car free of charge. But the male must pay. If he wants a tire changed, the fee is 50 cents.

This and other interesting stories of State operation of the Bay Bridge were related by Director of Public Works Earl Lee Kelly in a radio interview over station KPO in San Francisco on the evening of April 7.

With an average of 24,000 cars using the bridge daily, Mr. Kelly said, there were only seven accidents on the span during March, bringing the total of accidents on the bridge and its approaches to 50 for the four and a half months since it was opened.

GAS IS FURNISHED

If a motorist runs out of gas, Mr. Kelly said, the maintenance crew will provide him with three gallons of fuel at 30 cents a gallon, which, he added, is cheap enough when it is considered that such emergency gas is hauled an average of two miles to the car serviced.

"In March," Mr. Kelly said, "the average number of vehicles serviced per day was 22. That means that one out of every 1120 cars was serviced in one way or another. Six hundred and eighty-one cars were attended by the maintenance crew last month, bringing the total serviced since the opening of the bridge last November to 2,930. Some 378 drivers ran out of gas during March. That's about 13 a day. Eighty-seven tires were changed and 215 vehicles were towed off the structures. Only one fire was reported last month, making a total of ten since the bridge opened."

NO PEDESTRIANS ALLOWED

Director Kelly said that there has been only one instance where counterfeit money was passed to a toll collector and this was in the case of an innocent person who handed a collector a counterfeit one dollar bill on the Oakland side. When he reached the San Francisco end of the span a Highway Patrol officer was waiting for him and escorted him back to the administration building where he explained he himself had been duped and did not realize he had passed bad money.



Toll Sergeant J. Y. Borden inspects one of "cat's whiskers" used to reduce electric static in automobiles passing through toll gates of the San Francisco-Oakland Bay Bridge.

"Regarding the matter of pedestrians," Mr. Kelly said, "I would like to point out that the addition of pedestrian facilities to the bridge would have cost approximately $2,750,000 more; and that the number of pedestrians interested enough to cross the 11¾ miles of bridge and approaches would have been too few to have paid for these added facilities.

"The speed limit is that of all of our highways, forty-five miles an hour. There is some impression that motorists must go at this rate or suffer a penalty and there is still another impression that forty-five miles is the minimum. Both these impressions are wrong. First, the bridge offers a magnificent vantage point for scenic interest, and there are motorists who want to drive leisurely and enjoy the beauties of their trip. It is permitted these motorists to drive slowly, but they must use the outside lane along the bridge rail."

One of the features of the Bay Bridge which goes unnoticed by many motorists is the so-called "cat's whisker" device designed to eliminate electric shock occasioned when a driver passes coin to a toll collector. The "cat's whisker," placed on the pavement in front of each toll collection booth, consists of a small steel plate upon which is mounted vertically a thin piece of flat flexible steel. Each car crossing the bridge contacts this device which grounds the static charge generated by a moving car and thus prevents an electric charge which otherwise would be felt by driver and collector when coin is exchanged between them.

Snow Removal This Season Will Cost State $500,000

(Continued from page 6)

dates when various roads were closed, etc. This information is useful in connection with administration, but it is not possible to condense it within the limits of this article.

Considerable snow fell on the coast counties. Work was required to reach Mt. Hamilton in Santa Clara County and to clear the road over Mt. St. Helena in Napa County. There was a total fall of eighty-four inches on Ridgewood Summit and sixty-two inches on Rattlesnake Summit—both in Mendocino County. Over Oregon Mountain, on the Redwood Highway in Del Norte County, there was a total fall of 215 inches from December 24 to March 22.

As mentioned above, the Pacific Highway was closed for several days. The roads between Weed and Klamath Falls, Mt. Shasta and McCloud, and Yreka and Etna were likewise closed.

HARD WORK IN SISKIYOU

Conditions in the Siskiyou area were the most severe that have been experienced since snow removal work was started in that territory. Sections between Susanville and Doyle, Alturas and Cedarville, Susanville and Alturas, and Alturas and New Pine Creek—in Modoc and Lassen counties—were closed for periods varying from two to twelve hours. Temperatures as low as 36° F. below zero and heavy winds occurred in this area.

In the Sacramento Valley, 7 inches of snow fell at Woodland, 23 inches at the Lake County line, 14 inches at Willows, and 11 inches at Chico. On the Downieville lateral, 326 inches fell at Camptonville. Yuba Pass Summit was closed December 29, reopened January 9, and again closed January 16. This Pass has been opened during the past week. At Steep Hollow, east of Nevada City, 434 inches of snowfall was recorded, with an exceptionally heavy fall for the entire Nevada City and Grass Valley area.

At Norden, on Donner Summit, 403 inches fall has been recorded to March 25, with a probable 40 inches normal additional fall to the end of the season. On this route, for the period from January 28 to February 24, the road was closed to all traffic for an aggregate total of 58 hours, 25 minutes. During the same period heavy truck traffic was shut off for 284 hours, 55 minutes.

BLIZZARD CONDITIONS

It is to be understood that the snow removal equipment operated at all times. Traffic was held up because of poor visibility and resulting hazard.

Above Pine Grove on Route 34, to Camp Connell on the Big Trees road, and to Stoddard Springs above Sonora, only normal work was necessary.

East of the Sierras, between Markleeville and the State line, the fall was fairly heavy, and blizzard conditions made the work of the crew difficult. Likewise, on U. S. Route 395 from the State line to Bishop, a fall of 318 inches at Crestview and temperatures ranging as low as -38°, accompanied by heavy winds, made it necessary to tie up the equipment at times and allow the road to close. As soon as conditions permitted, the route was opened intermittently during the stormy period and has been in generally good condition.

TRAFFIC CONTROL PROBLEM

In the San Bernardino territory, the heavy traffic to Lake Arrowhead, Pinecrest, Big Bear and the Los Angeles Playground presents a problem of control as well as of snow removal to provide parking space and prevent tie-ups which might prove serious. Under the conditions, the available equipment was hard-pressed.

A section of Route 43 was closed for some time. Service to Big Bear was by way of Victorville and the Cushenbury Grade. The road to Camp Angelus was likewise closed for a time. The situation at both locations was complicated by earth and rock slides.

In the Los Angeles area, the delay on the Ridge Route has been described. The Angeles Crest Highway, San Gabriel Canyon and Maricopa roads were closed for short periods only. In the San Diego territory, no particular difficulty was encountered during the winter, although more area was covered and the expense was greater than normal.

West of the Sierras in the San Joaquin Valley, the road to Tehachapi and to the Women's Prison, the Walker Canyon, portions of Route 142 leading to Greenhorn Mountain, Coffee Camp to Quaking Aspen Meadows, Squaw Valley to Kings River through General Grant Park, Badger to Pinehurst, Tollhouse to Big Creek, Coarse Gold to Yosemite, and the El Portal route—all required more than the usual amount of work.

In connection with the removal work, some 2000 miles of road was sanded as icy conditions required. Every effort was made to safeguard traffic during the season by placing warning signs, insisting on use of chains, handling traffic under one-way control, and closing the road entirely as weather and road hazards made necessary.

The next phase to be undertaken is the opening of the routes where traffic conditions have not justified a year-round service. Several of the mountain routes are not sufficiently improved to make it possible to operate the heavy equipment required. Usually these roads are primarily recreational in character, and traffic would be intermittent at best, as there are no established communities along the line which do not have an outlet.

HASTE NOT ADVISABLE

It has been the experience of the highway organization, however, that practically nothing is gained by starting opening work too early in the season. When the weather warms up, the snow at the lower levels melts rapidly, and conditions at the higher elevations improve in corresponding degree. By delaying until the proper time, it has been found that the summits can be cleared by practically the same date, and at a considerable saving in expense over that which is necessary if opening is forced while the snow pack is frozen.

A list of the mountain routes to be opened, showing elevations and dates when it is expected the work will be accomplished, is as follows:

Rte.	*Summit*	*Elevation*	*Program dates*
21	Bucks Ranch	5700	May 1 to 15
47	Butte Meadows	--	April 15
83	Lassen Park	--	April 15
11	Echo Summit	7365	Apr. 20 to May 10
38	Emerald Bay	6500	May 15 to 20
34	Carson Pass	8650	May 25 to June 5
24	Ebbetts Pass	8800	June 5 to 15
13	Sonora Pass	9624	June 16 to 22
40	Tioga Pass	9941	June 10 to July 1



Relief for Snowbound

Chamber of Commerce,
Nevada City, California,
February 6, 1937.

Director Earl Lee Kelly,
Public Works Building,
Sacramento, California.

Dear Mr. Kelly:

Upon receipt of a letter from a business house in Washington, California, twenty or twenty-five miles from Nevada City, this afternoon, conveying the message that people in that little city were practically, hopelessly snowed in and with food supplies exhausted, claiming that the four or five miles of county road from Washington to the Junction House on the Tahoe-Ukiah Highway could be negotiated, but from that point for four or five miles, Nevada City way, it was impassable excepting with the use of skis. To the end of getting immediate relief for those in Washington, we contacted Senator Jerry Seawell at Roseville and was assured that he would immediately contact the proper State Department.

Before 12 o'clock today we heard from Mr. Stanley, in your office, and after acquainting him with the situation he showed positive interest and assured us that we would hear from him a little later. Within a reasonable time, Mr. Stanley phoned back to say that this afternoon, or this evening, there would be sent to this district on trailer, a 75 Cat and Bulldozer, and that work would be begun tomorrow upon that stretch of highway which today is impassable.

We are giving you and your office this letter promptly for the purpose of expressing appreciation by both the citizens of Nevada City and the little town of Washington.

Yours very truly,

CHAMBER OF COMMERCE,
F. E. CONNEA,
President.

April 7, 1937.

Mr. C. H. Purcell,
State Highway Engineer.

Dear Sir:

Following is a copy of a letter addressed to Foreman Rex Farmer from Mrs. Harry Fenn, which will be of interest to you:

"I am writing you in regard to a trip my husband, mother and I took to Bakersfield.

"On our return we had trouble with the fuel pump which failed to function correctly. We had no light or proper tools with which my husband could work. It was about 12 or 1 a.m. and we were afraid we were stalled until daylight. About that time, one of your men from the maintenance crew came by and helped us out of our predicament. He gave us a lantern to help heat the inside of the car as it was quite cold and windy that night. He fixed the fuel pump and followed us clear up the last grade of the Ridge Route to see that it was fixed properly. We had no more trouble getting home.

"I can't tell you how much we appreciated his help and wanted you to know how much we were helped."

The employee referred to by Mrs. Fenn was W. H. Smullin on night patrol duty on the Ridge Route during the winter storms.

S. V. CORTELYOU,
District Engineer.

Advertising the State

Mr. John W. Howe,
Editor Official Journal of the
Department of Public Works.

Dear Mr. Howe:

Just a word to voice my appreciation of the splendid magazine gotten out by the Department of Public Works.

I consider it the best piece of advertising in the State today. When the general public are more acquainted with our highways and bridges the more they will appreciate the wonders of the whole State.

The lessons taught in the publication on the lines of motoring safety are worth more than the cost of getting out the magazine.

Kindly keep up the good work, as you are doing a lot to help eliminate motoring hazards.

Very truly yours,

J. A. KASCH,
Cowell Portland Cement Co.

Clearly Portrays Progress

Stanford University, Calif.,
February 27, 1937.

California Highways and
Public Works,
P. O. Box 1499,
Sacramento, California.

Gentlemen:

I have enjoyed reading your periodical, "Highways and Public Works," from the standpoint of a citizen who is interested in the great engineering undertakings that are improving our California from day to day. I have never had the opportunity to read a magazine that so clearly and skillfully portrays the progress of these many and varied projects.

Sincerely,

COLUMBUS BALDO.

Agricultural Council of California,
Sacramento, Calif., April 6, 1937.

Mr. Earl Lee Kelly,
Director of Public Works.

Dear Mr. Kelly:

This letter is late, but it is, none the less, sincere.

During the heavy freeze in January of this year, when the entire citrus crop was in danger of destruction by the severe cold, some of our growers in Tulare County ran out of fuel, and the only way to get a supply of the solid fuel required for their particular kind of orchard heaters was to truck it over the Ridge Route from Los Angeles. This fuel had to be in the heaters that night, and it was essential that good speed be maintained in getting it over the Ridge Route, which was so heavily covered with snow that they were operating a one-way line.

I have before me a letter from P. E. Simpson, Assistant General Manager, Fruit Growers Supply Company, Los Angeles. This, as you probably know, is owned and operated by the California Fruit Growers Exchange, which is a farmers cooperative marketing association handling "Sunkist" oranges, lemons and grapefruit. In his letter, written March 1, after they were able to clean up the rush incident to the freeze, Mr. Simpson expresses the genuine appreciation of himself and his organization for the fine work done by Mr. Dennis in having his men on the Ridge Route see that the truckers got through with this fuel in time.

We want you to know of this situation and to assure you that such service is greatly appreciated by the farmers I represent, as it evidenced a real recognition of the opportunity for public service in an organization such as yours, and when Mr. Dennis and his men put themselves out very decidedly in order to render this valuable assistance in a most critical situation, we feel they deserve the very highest commendation.

Cordially yours,

R. H. TAYLOR,
Executive Secretary.

California Sends Delegates to Mexican Road Congress

By EDWARD J. NERON, Deputy Director of Public Works

WITHIN a year Californians will be motoring over picturesque highways from Nogales to Mexico City if plans laid at the International Road Congress in Mazatlan in Mexico last February are carried out.

At a convention of highway officials of the Southern Republic, California, Oregon, Arizona and British Columbia held in Mazatlan February 22–25, assurances were given by the Mexican government that work will be started at once on the Nogales-Mazatlan-Guadalajara link of the International Pacific Highway which ultimately will extend from Alaska to Buenos Aires in Argentine.

A report outlining the construction of the new road from the Mexican west coast to Mexico City submitted by T. H. Dennis, Maintenance Engineer of the California Division of Highways and engineers of the Automobile Club of Southern California and the California State Automobile Association was adopted by the convention.

MEXICO ATTRACTS CALIFORNIANS

It was the pleasure of myself and Mr. Dennis to represent Governor Frank F. Merriam and Director of Public Works Earl Lee Kelly at the congress, which was attended by the Governors of four Mexican states and by General Federico Montes, Commanding General of the State of Sinaloa, and Federal Secretary of Communication Vincente Cortez Herrera, personal representatives of President Cardenas of Mexico.

Since the opening last year of the Laredo-Mexico City Highway thousands of American motorists have driven from the Texas border city to the capital of Mexico. Hundreds of Californians have traveled 1500 miles to Laredo in order to make the 760-mile run to Mexico City.

With the completion of the Nogales-Mazatlan-Guadalajara road there should be a big influx of motorists from California into Mexico and this State should benefit in a large way from Mexican visitors.

CONVENTION ENTHUSIASTIC

The purpose of the Mazatlan convention was to devise ways and means of financing the building of the proposed west coast highway, some 1630 miles long, between Nogales and Guadalajara. The route will pass through the states of Sonora, Sinaloa, Nayarit and Jalisco eventually forming a loop road with the present Laredo-Mexico City highway in addition to serving local needs. Such a highway undoubtedly will stimulate tourist interest in our historic neighboring republic.

The large attendance at the congress, the enthusiasm displayed and the business-like handling of the affairs of the convention augur well for the success of the undertaking.

Numerous communities from the four Mexican states were represented, the delegates being selected from many business, farming and political groups and travel bureaus. Entire harmony prevailed on the questions of routing.

MUST CONQUER BAD LANDS

The main problem confronting the Mexican highway officials in connection with the new road is in getting across the barrancas of Nayarit and Jalisco. Here is a short stretch of deep gorges. As soon as a highway is constructed through these bad lands it will be possible to drive from the California border via the west coast to Mexico City in dry weather. Motorists will be able to visit such points of interest as Culiacan, Mazatlan, Tepic, the Barrancas, Guadalajara, Chapala and Patzcuaro lakes and Morelia enroute to the Mexican capital.

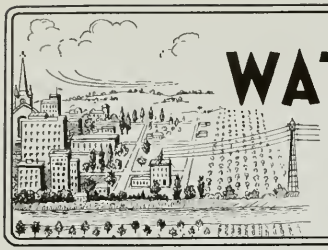
The California delegation gave assurance of complete cooperation in

(Continued on page 28)





Scenes enroute from Nogales to Mazatlan, Mexico, and prominent figures at International Road Congress held there last February. At top, Speakers Table, left to right: C. Francisco Parra, Governor of Nayarit; Paul J. Montet, Governor of Jalisco; Edward J. Neron, Deputy Director of Public Works, California; General Federico Montes, Commanding General, State of Sinaloa, and permanent chairman of Congress; Governor Alfredo Delgado, Sinaloa; Hon. I. Soto, Director of Publicity, Sonora; Senor M. Blanco, President West Coast Highway Association of Mexico. Top center: One of several man-power ferries on Nogales-Mazatlan route. Left center: Stretch of fair road. Right: Mexican highway sign on good, graded gravel road and below bad section of road through dry wash.



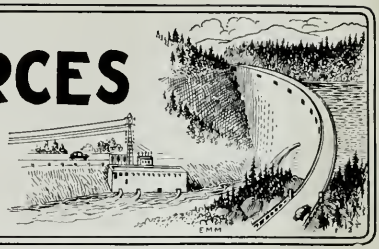
DIVISION OF WATER RESOURCES

OFFICIAL REPORT

FOR THE MONTH OF

March, 1937

EDWARD HYATT, State Engineer



During the last week of February and the first few days of March, this season's second progress survey of snowpack conditions throughout the mountains was made by all those organizations and parties participating in the field work of the California Cooperative Snow Surveys.

The results of the snow surveys revealed that the snowpack of the Sierra, in all watersheds lying south of the Stanislaus River, was from 5% to 20% better than at the same time a year ago. Over the area lying between the Stanislaus River on the south and the Feather River on the north, the snowpack was from 10% to 30% behind that of last year, while the watershed of the Upper Sacramento-McCloud-Pit Rivers showed only 60% as much snow as at this time last year. This last named watershed is the only one that showed any considerable shortage when the amount of snow on the ground is compared with the amount normally present at the end of the snow accumulation season—generally assumed as April 1st. In all other watersheds, the snowpack was within 20% of the April 1st normal, below in the north and above in the south. In the Upper Sacramento-McCloud-Pit area, however, the March 1st snowpack was only 40% of the amount normally found there at the first of April.

IRRIGATION DISTRICTS

Two irrigation districts in Tulare County were formally organized during the month to contract for purchase of water from the Friant-Kern Canal of the Central Valley Project, the Lindmore District, embracing an area of 32,000 acres lying west of Lindsay and Strathmore, and the Exeter Irrigation District consisting of 13,000 acres, including the town of Exeter and a highly developed strip along the foothills.

A report was made to the Board of Supervisors of Kings County on March 18th, approving organization plans of the Kings River Delta Irrigation District comprising 3100 acres on the northern edge of Tulare Lake bed near Stratford.

District Securities Commission

The District Securities Commission held its regular meeting in Sacramento on March 4th for consideration of applications presented by districts operating under its supervision. Among other matters, assessments levied by Byron, Bethany and Oroville-Wyandotte Irrigation Districts for the year 1936–37 were given approval. A refunding bond issue in the amount of $96,000 by Jacinto Irrigation District was considerd and approved for certification by the State Controller. A contract providing for the expenditure of $17.535 for purchase of water meters by Paradise District was authorized to conserve the water supply.

FLOOD CONTROL AND RECLAMATION

Sacramento Flood Control Project

During this period a series of rains occurred which made necessary the operation of the drainage pumping plants in the Sutter By-pass. A small amount of routine maintenance work and patrolling was done. The dragline has continued clearing canals tributary to Pumping Plant No. 2.

The storms during the period caused two rises in the Sacramento River and its tributaries, but at no point was the stage high enough to cause alarm. On the new levees along the Sacramento River above Colusa and on the Feather River south of Marysville, a small amount of wash occurred, but the levees were not endangered and the damage was limited to the earth material washed away. The U. S. War Department installed temporary protection at the Sartain and Terrill ranch north of Colusa.

Relief Labor Work

During this period approximately 120 men were engaged in clearing the overflow channel of the Feather River north of Marysville and near Nicolaus. SRA Transient Camp No. 7 in the Sutter Basin furnished approximately 50 men for clearing in the Tisdale By-pass, but considerable time was lost on account of rains.

A WPA flood control emergency project has been set up, for which $250,000 has been allocated for use throughout the State "to provide for necessary emergency work when danger to life or grave risk to property is engendered by flood, or thaw conditions." Under this project relief labor may be transferred promptly from other projects to points where danger exists. Transportation, materials and other costs must be defrayed by the State or local intersts. The activities under this project in District No. 2, which includes all of the Sacramento Valley except in San Joaquin County, are cleared through this office.

SUPERVISION OF DAMS

Application for approval of the plans and specifications for enlargment of the Crater Lake Dam owned by W. F. Dressler and F. H. Settelmeyer of Minden, Nevada, was approved on February 20, 1937. This dam is an earthfill 30 feet in height with a storage capacity of 320 acre-feet and is estimated to cost $3,000.

At the Caljalco Dam of the Metropolitan Water District cut-off excavation has been practically completed.

The fill at San Gabriel Dam Number 1 of the Los Angeles County Flood Control District is reported to be approximately 70% complete.

Work on the enlargement of O'Shaughnessy dam of the City and County of San Francisco has been resumed following a temporary lay-off due to the extremely severe winter season.

Work at the Empire Weir of the Tulare Lake Canal Company has been deferred because of extreme floods in the Kings River.

WATER RIGHTS

Supervision of Appropriation of Water

During the month of February, 19 applications to appropriate water were received. 11 were denied and 16 were approved. Eight permits were revoked and the rights were confirmed under 5 permits by the issuance of license.

Reports have been prepared covering 192 field inspections made during the 1936 season and the preliminary lists for investigation during the 1937 season are prepared. Two hundred and thirty-three cases are tentatively listed, some of which doubtless will be eliminated.

SACRAMENTO-SAN JOAQUIN WATER SUPERVISION

Intermittent storms during the past month have resulted in a large sustained stream flow into the delta with the result that the water in Suisun Bay is fresh as far as Bullshead Point, and the effect of the high stages on March 22d (80,000 c.f.s. at Sacramento and 11,000 c.f.s. at Lathrop resulting from the storm over the week end) should further freshen up San Pablo Bay.

Figueroa Viaduct Nears Completion

(Continued from page 15)

piers and abutments which are skewed to meet the existing conditions. The south abutment parallels the tracks of the Southern Pacific Railroad. Piers on each side of the Los Angeles River parallel its course at the site, and the tracks of the Southern Pacific on the north bank. The north abutment and north pier parallel San Fernando Road.

The concrete span over San Fernando Road and the Los Angeles Railway tracks has a clearance of 22 feet. The roadway at San Fernando Road is 27 feet above the street. The viaduct is on an easy two and one-quarter per cent ascending grade in a southerly direction to meet existing highway through the tunnels. The roadway is approximately 51 feet above the Southern Pacific tracks near the mouth of the tunnel. The center of the 200 foot span over the river roadway is approximately 72 feet above the stream bed.

Reinforced concrete spans are supported by four girders with curved soffits which have the appearance of flat arches. Girders vary from about 4 feet in thickness at the center of the spans to 7 feet thickness at the haunches. Over the Los Angeles River and the Southern Pacific tracks there are three structural steel plate girder spans of variable length.

200-FOOT GIRDER SPAN

The center span over the Los Angeles River is 200 feet in length and is one of the longest plate girder spans in the country. The other two steel spans are 104 and 127 feet in length respectively. The steel girders like the concrete girders also have curved soffits.

The design of the steel girders is somewhat unusual. The ordinary plate girder has a single web plate, flange angles, and cover plates. In the construction of the viaduct girders double web plates were used with a filler plate between.

Clinton Construction Company is general contractor on the project.

"The boss just made me manager of his doughnut factory."

"Congratulations. Are you in charge of everything?"

"Yeah, the hole works."

Highway Bids and Awards of Contracts for the Month of March

GLENN COUNTY—Between 4 and 6 miles east of Butte City, 4 reinforced concrete slab bridges on concrete pile bents to be constructed and roadway approaches to be graded and roadmix surface treatment to be applied. District III, Route 45, Section C. Earl W. Heple, San Jose, $56,681; F. O. Bohnett, San Jose, $52,208; Peter J. McHugh, San Francisco, $54,952; Frederickson & Watson Construction Co., Frederickson Bros., Oakland, $53,438; Lord & Bishop, Sacramento, $55,241; N. M. Ball Sons, Berkeley, $57,438; Frank C. Amoroso & Sons,, San Francisco, $58,463; John Rocca, San Rafael, $59,629; A. Soda & Son, Oakland, $67,741; Contract awarded to Charles Kuppinger, Lakeport, $48,289.

LOS ANGELES COUNTY—Between Fenwick St. and Terra Bella St., in Los Angeles, 2.9 miles to be graded and paved with asphalt concrete and Portland cement concrete. District VII, Route 9, Section L.A. Matich Bros., Elsinore, $159,788; George J. Bock Co., Los Angeles, $141,802; Claude Fisher Co., Ltd., Los Angeles, $140,-715; Dimmitt & Taylor, Los Angeles, $157,468; Gogo & Rados, Los Angeles, $152,636; Griffith Co., Los Angeles, $136,-294; P. J. Akmadzick, Los Angeles, $140,249; United Concrete Pipe Corp., Los Angeles, $130,734; J. E. Haddock, Ltd., Pasadena, $127,794; B. G. Carroll, San Diego, $129,271; Oswald Bros., Los Angeles, $129,635; Contract awarded to C. O. Sparks & Mundo Engineering Co., Los Angeles, $121,320.

LOS ANGELES COUNTY—Two reinforced concrete girder bridges across Big Tujunga Wash, 1 across north branch, consisting of 12 spans each 54 feet, to be widened and reconstructed, and the other across the south branch consisting of three 55-foot spans and two 18-foot end cantilevers to be constructed. District VII, Route 9, Section L.A., J. F. Knapp, Oakland, $145,815; R. R. Bishop, Long Beach, $154,965; Bent Bros., Inc., Los Angeles, $176,360; Oscar Oberg, Los Angeles, $141,342; Andy Sordal, Long Beach, $157,276; T. A. Allen Construction Co., Los Angeles, $141,489; Gates and Huntley, Los Angeles, $151,082; Atlas Construction Co. and C. F. Robbins, Pasadena, $141,-416; Charles J. Dorfman, Los Angeles, $139,665; C. O. Sparks and Mundo Engineering Co., Los Angeles, $133,682; Griffith Co., Los Angeles, $158,329; J. E. Haddock, Ltd., Pasadena, $144,024; Carlo Bongiovanni, Los Angeles, $187,994. Contract awarded to Byerts & Dunn, Los Angeles, $124,887.

PLACER COUNTY—Between Rocklin and Loomis, about 2.9 miles to be graded and paved with Portland cement concrete. District III, Route 17, Section A. Fredericksen & Westbrook, Lower Lake, $129,466; N. M. Ball Sons & Larsen Bros., Berkeley, $124,443; A. Teichert & Son, Inc., Sacramento, $127,488; Frederickson & Watson Construction Co. and Frederickson Bros., Oakland, $127,711; Hanrahan Co., San Francisco, $129,054. Contract awarded to Basich Bros., Torrance, $122,902.36.

SAN DIEGO COUNTY—Apply diesel oil to roadside vegetation. District XI, various routes and sections. Weed Eradicators Inc., Santa Ana, $1,960; Gilmore Oil Co., Los Angeles, $1,858; Regal Oil Co., Long Beach, $1,536. Contract awarded to Consumers Oil Co., Los Angeles, $1,254.30.

SAN DIEGO COUNTY—Between Las Flores Underpass and 1 mile south of San Onofre, 8.0 mi. to be graded, paved with Portland cement concrete, and plant-mixed surfacing on crusher run base to be placed. District XI, Route 2, Section D. United Concrete Pipe Corp., Los Angeles, $489,284; Basich Bros., Torrance, $463,754; W. E. Hall Co., Alhambra, $485,407; Lewis Construction Co. & Bodenhamer Construction Co., Los Angeles, $461,640; Gogo & Rados, Los Angeles, $470,117; Southern California Roads Co., Los Angeles, $511,812; V. R. Dennis Construction Co. San Diego, $468,-845; Griffith Co., Los Angeles, $429,164; Oswald Bros., Los Angeles, $482,985; George R. Daley Corp., Los Angeles, $504,874; C. O. Sparks and Mundo Engineering Co., Los Angeles, $493,248; Sharp & Fellows Contracting Company, Los Angeles, $454,369; B. G. Carroli & C. B. Grove, San Diego, $509,-112; Metropolitan Construction, Los Angeles, $429,644; J. E. Haddock Co., Ltd., Pasadena, $481,555. Contract awarded to David H. Ryan, San Diego, $411,880.35.

SAN JOAQUIN AND STANISLAUS COUNTIES—Between Vernalis & Gates Road, 4.6 miles to be graded and roadmix surface treatment applied. District X, Route 110, Section A. Peter J. McHugh, San Francisco, $53,898; Charles L. Harney, San Francisco, $60,973; George French Jr., Stockton, $54,446; Lee J. Immel, Albany, $50,696; Leo F. Piazza, San Jose, $49,393; Louis Biosotti & Son, Stockton, $51,571; United Concrete Pipe Corporation, Los Angeles, $57,052; A. Teichert & Son, Inc., Sacramento, $48,762; Hanrahan Company, Sacramento, $58,904; Fredrickson & Watson Construction Co., Fredrickson Bros., Oakland, $56,819; Earl W. Heple, San Jose, $51,981; Claude C. Wood, Stockton, $54,827; E. A. Forde, San Anselmo, $57,387; N. M. Ball Sons & Larsen Bros., Berkeley, $57,231; J. R. Reeves, Sacramento, $65,458. Contract awarded to Basich Bros., Torrance, $46,285.80.

SAN LUIS OBISPO COUNTY—Widen creek across Santa Margarita Creek, 13 miles north of San Luis Obispo. District V, Route 2, Section C., F. O. Bohnett, San Jose, $8,000; Theo. M. Maino, San Luis Obispo, $9,060; Robert D. Patterson, Santa Barbara, $10,685. Contract awarded to Earl W. Heple, San Jose, $7,186.06.

Wife—I expect all my daughters to make brilliant marriages.

Husband—You can't expect them to follow you in everything, my dear.

"I'm quitting my job as Mr. Brody's secretary."

"Well, he'll never have as pretty a one as you again."

"You're darn right. I'm marrying him."

California Sends Delegates to Mexican Road Congress

(Continued from page 24)

working out a program for construction of the highway and of future assistance in helping to increase motor travel over the road.

Among the California delegates was H. W. Keller, vice president of the Automobile Club of Southern California, who conceived the international highway about six years ago and who last year made a trip to Mexico City and convinced the Mexican government of the importance of calling the Mazatlan road congress.

WILL ISSUE ROAD BONDS

The congress generally favored the issuance of bonds of small denominations to stimulate a wide interest and encourage general subscription by the small investor. The bonds would be backed by the Bank of Mexico and eventually retired with the tax collected in the four states from the sale of gasoline. The present price of gasoline in our money is 28 cents, of which 8 cents is tax. This tax is now collected by the National government which fixes the tax as well as the price of gasoline per gallon.

At the Mazatlan meeting the states were assured that the government would forego this tax and match any amount they could raise from this source.

The meeting also favored the plan offered by E. E. East, Chief Engineer of the Automobile Club of Southern California, of organizing and equipping a competent Maintenance Department which would immediately begin to recondition the present road.

PLAN IS ADOPTED

This organization would grade to a turn pike section all milage now on a suitable location, realigning the balance as funds permitted. Sections now impassable during the winter season by reason of poor sub-soil would be stablized with sand or gravel, of which there is an abundance within economical haul. Road standards would be continually adjusted to traffic needs on a pay as you go basis.

While there are a number of large rivers between Guaymas and Mazatlan, these are now either being ferried across or forded and a continuance of this practice would work no great hardship until they could be more adequately provided for. As traffic justified, the surface of these roads could be treated with oil, particularly adjacent population and industrial centers.

The total mileage involved in this West Coast road is approximately 1630 miles of which 250 miles is already completed.

SOME SECTIONS COMPLETED

The longest section of completed work lies between Nogales and a point 30 miles South of Hermosillo, a distance of 210 miles. The remaining sections cover approaches to the towns of Sinaloa, Mazatlan and Guadalajara. These sections are built to modern standards and are a delight to travel. Of the intervening sections, particularly those driven by the invited guests, it would be more charitable to omit their description, beyond saying, they could be travelled once, at 10 miles per hour.

In the main the road traversed broad plateaus flanked by either low hills or mountain ranges. The northern part resembled our Mother Lode country, that near Mazatlan, the territory in and about Victorville in San Bernardino County.

While the majority of traffic met is of the equiestrian, burro back, and ox-cart types, still in the larger towns of Hermosillo, Guaymas, Los Mochis, Culican and Mazatlan modern taxies vied for business with the two and four wheeled horse drawn cabs. The drivers of each zealously blew their horns at every street intersection and then proceeded at full speed down the narrow streets, forcing pedestrians to leap for their lives. With it all, however, was a spirit of play, not evident here.

One will be bound to remark the universal courtesy displayed by the Mexican people to all visitors, particularly Californians, and it seems the desire of most of them to visit our State. The magnificent churches, the town plazas and markets offer an attraction that few will not appreciate. The building of the West Coast Highway will make those things more easily accessible to Californians, and California nearer to the people of our neighboring republic.

Stanton Has New Hobby. Collecting His Own Obituaries

"Some one else may write, you will never read, your obituary."

State Highway Commissioner Philip A. Stanton of Anaheim does not accept this old saying as a truism.

Two years ago, when Commissioner Stanton was at the point of death after a long illness and his physicians held out no hope for his recovery, California newspapers prepared and set in type news and editorial obituaries highly eulogistic of Mr. Stanton and his extended public career. These never appeared in print. Commissioner Stanton made a miraculous recovery and resumed his active duties as a member of the Highway Commission.

Mr. Stanton has many friends in the newspaper game and the idea of collecting the obituaries they had written about him appealed to him. He has obtained a number of them, typical of which is one that starts off in this vein:

"Death of Phil Stanton, whose passing came this week after a prolonged illness, removes a citizen who had given unstintedly of his time, his ability and his fortune to the betterment of California government."

"'Some one else may write, you will never read, your obituary,'" quotes Mr. Stanton. "But I did," he adds.

"Dobbins, the critic, has roasted my picture unmercifully."

"Don't mind that fellow. He's no ideas of his own; he only repeats like a parrot what all the others say."

"Poor ole Bill! 'E's so shortsighted 'e's working himself to death."

"Wot's 'is short sight got to do with it?"

"Well, 'e can't see when the boss ain't looking, so 'e 'as to keep on shovelling all the time!"

STATE OF CALIFORNIA

Department of Public Works

Headquarters: Public Works Building, Eleventh and P Sts., Sacramento

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JUSTUS F. CRAEMER_____Assistant Director

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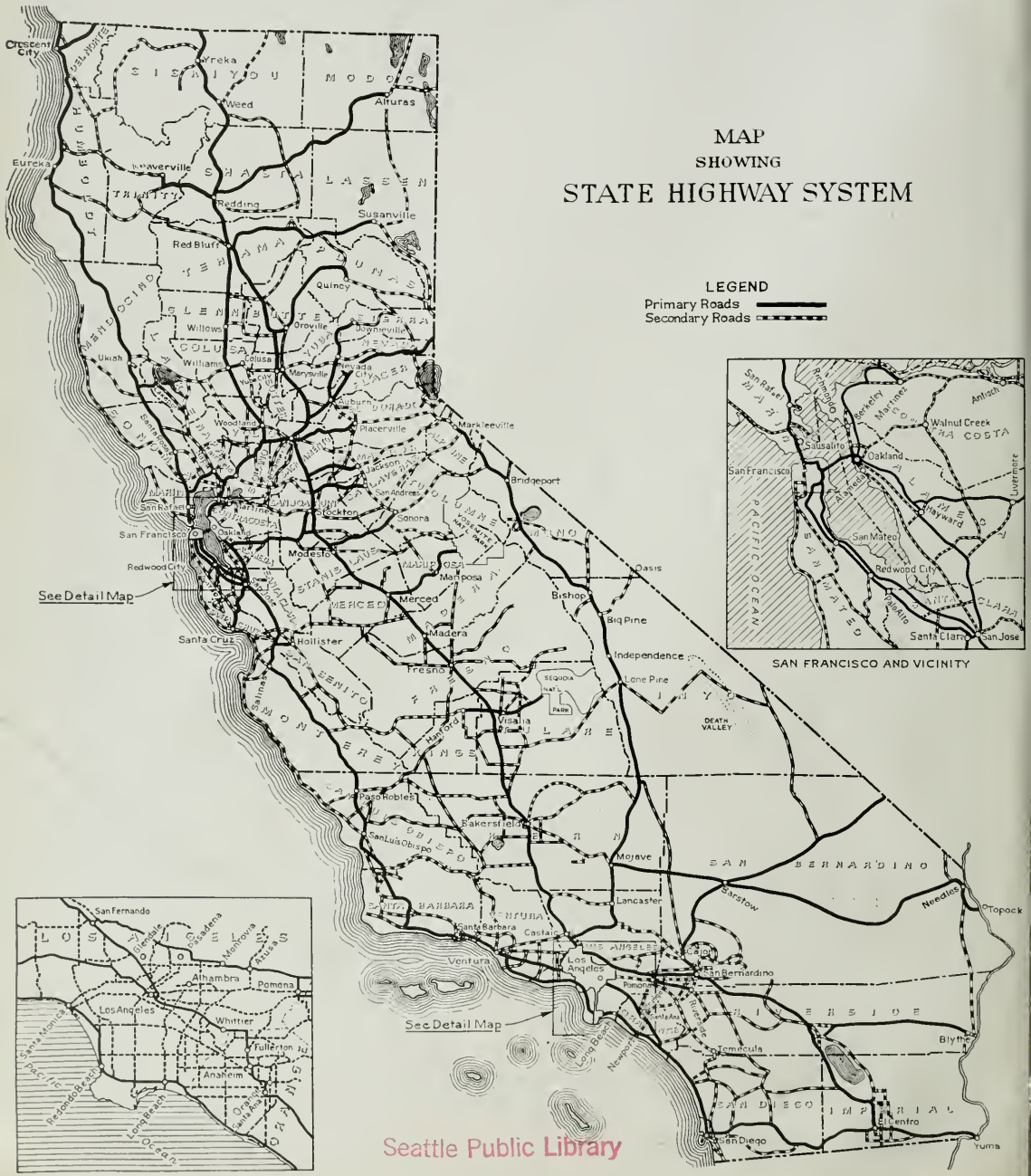
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California

HIGHWAYS AND PUBLIC WORKS



GOLDEN GATE BRIDGE ACROSS FAMED ENTRANCE TO SAN FRANCISCO BAY.

Official Journal of the Department of Public Works

MAY · 1937

JUL 15 1937

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways of the Department of Public Works, State of California

EARL LEE KELLY, Director | C. H. PURCELL, State Highway Engineer | JOHN W. HOWE, Editor

Published for information of the members of the department and the citizens of California

Editors of newspapers and others are privileged to use matter contained herein. Cuts will be gladly loaned upon request.

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Cities Share of Gas Tax For Present Biennial Period $13,311,614.74

Seattle Public Library

By L. V. CAMPBELL, Engineer of City and Cooperative Projects

APPORTIONMENT by the Department of Public Works through the Division of Highways of the April, 1937, quarterly apportionment of gas tax funds in the sum of $1,750,537.61 for expenditure within corporate limits of municipalities brings the total amount of these funds received by 282 California cities for this purpose to $13,311,614.74 for the biennial period ending June 30 of this year.

This biennial total combined with $5,291,693.72 allotted to the cities from gas tax revenues accrued during the 1933–1935 biennium, brings the cities a total subvention from the gas tax to date of $18,603,308.46, exclusive of State highway funds appropriated by the California Highway Commission for expenditures within municipalities.

The $13,311,614.74 represents the legislative allocation of the net proceeds of ½ cent of the gas tax to the cities for the biennium now drawing to a close.

The total apportionment combines ¼ cent of the gas tax, or $7,047,166.90 alloeated by the 1933 Legislature for expenditure upon designated State highway routes within incorporated cities, as provided under Section 203 of the Streets and Highways Code, and ¼ cent of the gas tax, or $6,264,447.84, subsequently alloeated by the 1935 Legislature for use upon streets of major importance other than State highway routes as provided under section 194 of the Streets and Highways Code.

During the fiscal year ending June 30, 1936, the apportionment was divided into $3,350,101.11 for the acquisition, maintenance and improvement of State highways, and $2,567,423.96 for a similar purpose on streets of major importanee.

While the law provides one-quarter cent for eaeh of these purposes, the amounts being determined upon a per capita basis, the varianee between the two amounts for the fiscal year ending last June 30 is due to the faet that no provision was made for an apportionment for streets of major importance out of revenue aeeruing from the first, or July, 1935, quarterly apportionment, which preceded the effective date of the governing legislative act on September 15, 1935.

The ¼ cent for eity streets of major importance for the fiscal year period ending June 30, 1937, also is less than the apportionment for State Highways of this period by $41.91. This amount was deducted from the concluding April, 1937, quarterly apportionment to help cover costs incurred under an appropriation to the Code Commission engaged with drafting of the Streets and Highways Code.

The cost of drafting the Streets and Highways Code was defrayed from the gas tax funds appropriated for that purpose by Chapter 698, Statutes of 1935, the share of the cities apportionment totaling $2,541.91. A previous deduction of $2,500 was made from the preceding 1935–1936 fiscal year apportionment and to this it was necessary to add an extra $41.91.

How $13,311,614.74 Gas Tax Was Divided Among Highway Districts*

	District Headquarters	State Highway	Streets of Major Importance
District I	Eureka	$51,295 82	$45,583 30
District II	Redding	34,094 69	30,316 70
District III	Marysville	254,749 99	226,389 02
District IV	San Francisco	2,247,460 53	1,997,570 97
District V	San Luis Obispo	146,549 80	130,261 94
District VI	Fresno	241,235 00	214,373 47
District VII	Los Angeles	3,288,582 47	2,923,119 10
District VIII	San Bernardino	219,331 26	195,129 65
District IX	Bishop	1,902 82	1,690 92
District X	Stockton	214,022 78	190,577 41
District XI	San Diego	347,941 74	309,435 36
Grand totals		$7,047,166 90	$6,264,447 84

* Allocations to cities in each highway district shown on pages 13–16

POPULATION INCREASE

The capita base upon which the apportionment was made was raised from 4,265,764 given in the Federal census of 1930 as the population of incorporated eities to a total of

(Continued on page 13)

Golden Gate Bridge Ready For Dedication on May 28

WITH her far-famed bay already spanned by the greatest over-water structure in all the world, an achievement visioned by pioneers of her early days, San Francisco, on May 28, will see the fulfillment of another dream of California Argonauts when the Golden Gate Bridge across the entrance to San Francisco harbor is formally opened.

The San Francisco-Oakland Bay Bridge was built by the State of California. The Golden Gate Bridge was financed by six coastal counties of northern California with the State Division of Highways cooperating by building the Marin approach highway which will cost about $2,000,000, as monuments to engineering skill and progressive public spirit.

A five-day Fiesta eclipsing any civic celebration ever attempted in San Francisco will commemorate the dedication of the giant span arching the Golden Gate. Mexico and Canada and all the western States will join with the hostess city and the counties of the Redwood Empire of northern California in observing the occasion.

PEDESTRIANS TO HAVE DAY

For eleven days, San Francisco will indulge in revels, pageantry, parades and civic demonstrations—thrilling shows on land, on water and in the air.

Before the opening day of the Fiesta proper on May 27, there will be a preholiday program consisting of a ceremony of blessing the bridge on May 23, a Radio Stars Show in the Civic Auditorium Tuesday night, May 25; a city-wide luncheon at the Palace Hotel on May 26 and a Queen's Coronation ball that night at the Civic Auditorium.

Pedestrians will have their day on May 27, when no vehicular traffic will be permitted on the huge span. This will mark the opening of the Fiesta.

A highlight of the Fiesta will be the mobilization of cavalcades originating in Canada, in Mexico and western States and joining at the bridgehead on the Marin shore on May 28, the day of the bridge dedication.

FLEET WILL PARTICIPATE

On that date the United States Battle Fleet will arrive from Pacific maneuvers with approximately 50,000 officers and men to participate in the celebration.

In Crissy Field in the Presidio a huge amphitheater is being created for the staging of an historical pageant, telling the story of the upbuilding of California, with a cast of 3000 actors and singers and an orchestra of 100 musicians. Seating accommodations will be provided for 25,000 persons.

Four of the greatest parades San Francisco has ever seen will brighten the Fiesta. Floats of rich and novel design will lend color to the spectacle, with entries scheduled from all the western States and from foreign countries. Bridge workers will be in the line of march. The Army and the Navy will lend to the parades the martial dignity of national participation. These parades are for Thursday, May 27, May 28, the night of May 29, and Memorial Day, May 31. Grandstands will be ready along the line of parade.

HONOR FOR BRIDGE HEROES

Those who lost their lives building the bridge will be remembered at a simple ceremony of religious nature on Memorial Day at the center of the bridge with the children of all the schools, public, private and parochial, dropping flowers into the bay. Of a more material nature will be the Labor Ball of May 29 at the Civic Auditorium, the net returns of which will be given to the families of those who lost their lives building the bridge.

A sports program of infinite variety will run all through the Fiesta period.

For many weeks preparations for the Fiesta have been in progress under the direction of a committee of which Supervisor Arthur M. Brown, Jr., is chairman, and Eric Cullenward general manager. Through them San Francisco invites the world to be her guests for eleven days beginning May 23.

The main center span of the Golden Gate Bridge is the largest single span of any suspension bridge in the world. It is 4200 feet long, 700 feet longer than the George Washington Bridge over the Hudson River.

GIANT TOWERS

Its two giant towers, one off San Francisco's Presidio shore and the other on the Marin County bluff to the north, are 746 feet high, 313 feet taller than the Russ building on Montgomery Street in San Francisco.

The minimum vertical clearance at center is 220 feet above mean high water; the maximum clearance is 236 feet above mean low water—the greatest navigation clearance in the world, far above the mast height of any ship afloat or building.

The total bridge width is 90 feet, divided into a 60-foot roadway, with six lanes for vehicular traffic and two 10½-foot clear width sidewalks.

The grand total length, including the two approach roads, or from Waldo Point in Marin County to the Marina Gate of the Presidio in San Francisco, all embraced in the project, is seven miles.

There are two side-spans—1125 feet each—and if these are added to the 4200 feet of the main center span, there is a total length of the bridge proper of 6450 feet, or one and one-fifth miles.

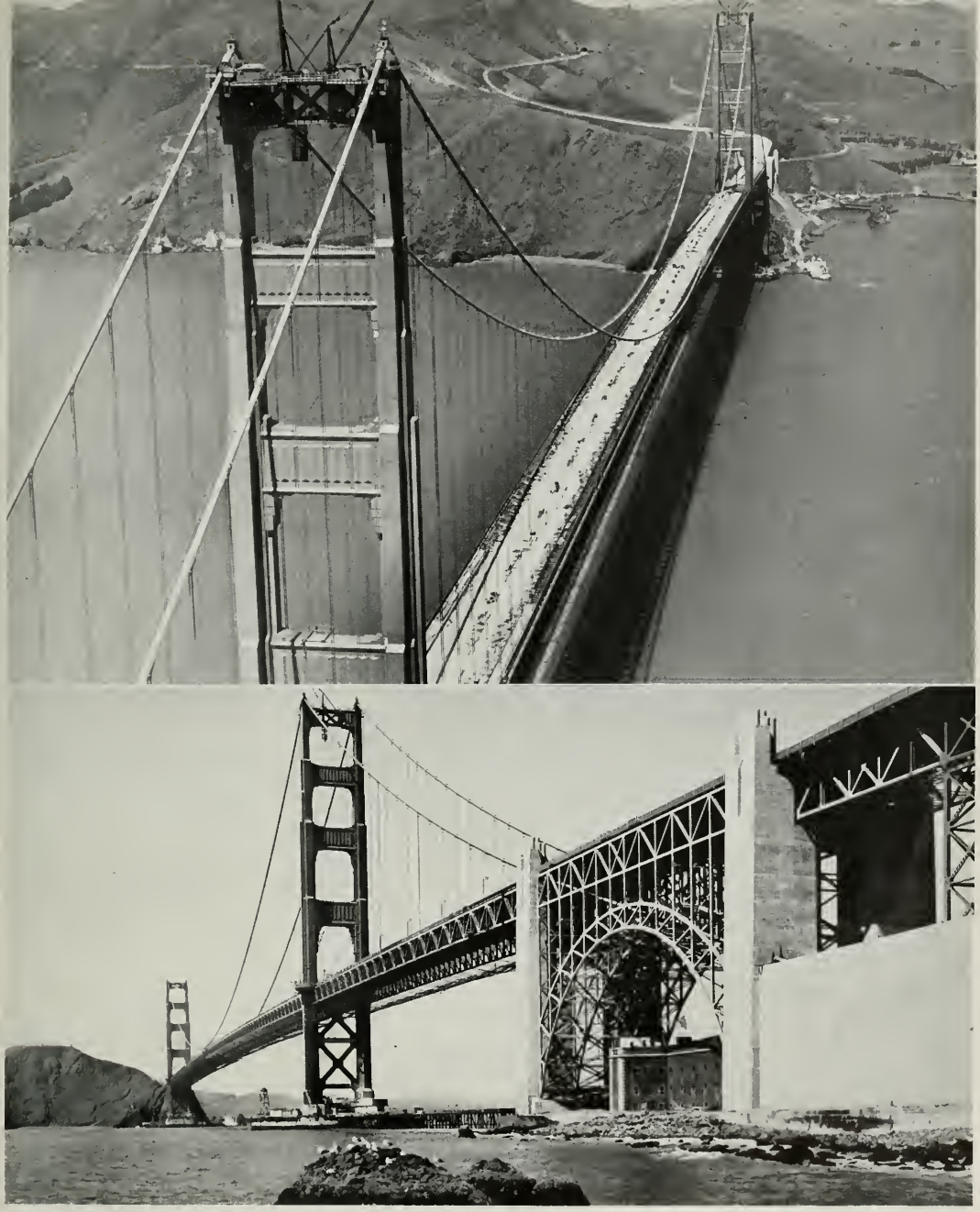
SIX COUNTIES BACK PROJECT

In the initial plans for the Golden Gate Bridge there were two features that aroused controversy.

First, the unprecedented length of span—4200 feet, or more than twice as long as that of any other bridge that had been erected up to the time when the plans were first made; and second, the problem presented in building the south pier, 1100 feet off shore, in water varying from 65 to 100 feet in depth and subject to extreme storm and tidal conditions.

Confident that the bridge could be built, six counties banded together to form the Golden Gate Bridge and

(Continued on page 17)



The Golden Gate is bridged! Upper photo is an aerial view of world's longest suspension span showing Waldo approach on Marin side, built by State, winding from northern bridgehead over mountain and through tunnel leading down to Waldo Point. Lower photo shows sweep of bridge from San Francisco side. Historic Fort Mason appears under arch span in foreground.

Marin Approach to Golden Gate Bridge Built by State

By EARL LEE KELLY, State Director of Public Works

WITH the completion of the Golden Gate Bridge, California motorists can view with justifiable pride their proprietary interest in this great undertaking.

They may drive on to the world's largest and longest over-water suspension span from the Marin shore over a highway approach they themselves built with the monies they contributed to the gasoline tax fund. And in doing so they will travel over one of the biggest single projects for road construction ever entered into by the Division of Highways.

The State of California, through the Department of Public Works, will have expended approximately $2,000,000 for the Waldo approach to the Golden Gate Bridge. An outstanding engineering job, this northerly approach is the State's share of a monumental achievement.

TOLL FREE IN FUTURE

It will come to its complete fruition in the service of the people and the development of the great Redwood Empire of northern counties when this bridge becomes toll free at the expiration of the bond payment period. The inclusion of this provision for eventual free tolls in the financing of the Golden Gate Bridge is in keeping with the purpose of the State to make all California highway bridges free for the use of the motoring public that pays for them through their gasoline taxes.

Final action providing for the construction of an adequate highway approach on the Marin side of the bridge was taken by the California Highway Commission on January 3, 1936, when that body allocated the sum of $1,250,000 to supplement the $500,000 budgeted for that purpose in the budget for the 87th–88th fiscal years.

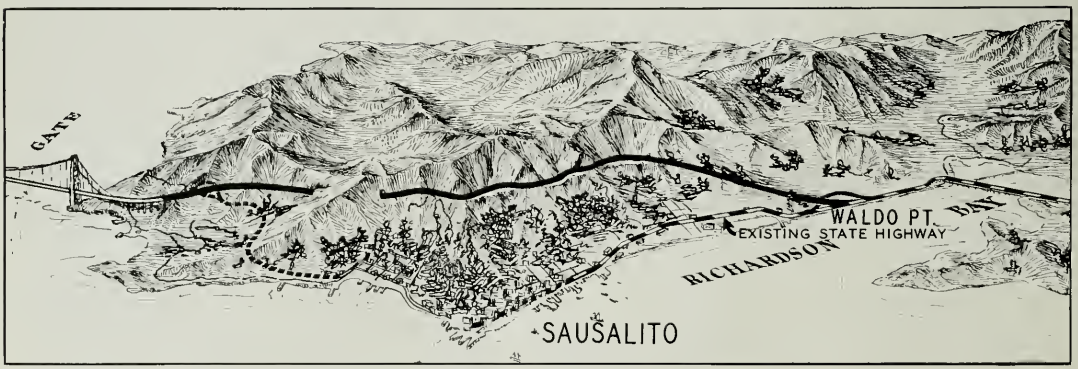
Construction of this project was planned originally on the basis of a three-lane pavement, as it was felt that the potential slides were of such magnitude that the necessary excess excavation due to slide removal would develop sufficient material to provide for a four-lane width.

PLANS CHANGED

After much local discussion, however, plans were changed to provide for initial construction of a four-lane width. That slide excavation has increased the original estimate of 1,813,000 cubic yards by more than 700,000 cubic yards has borne out the soundness of the engineer's original plan.

With this amount of $1,750,000 available, the Department of Public Works awarded two contracts for the work.

One provided for grading a roadbed 46 feet and 66 feet wide and placing plant mix surfacing on crusher run base 42 feet and 62 feet wide on an alignment through the hills in back of Sausalito. The new road connects with the existing Redwood Highway at Waldo Point near the Richardson Bay Bridge and is about three and one-half miles long.



Sketch shows course of State's approach to Golden Gate span from Waldo Point through tunnel to the bridge.

The other contract provided for the boring and lining with reinforced concrete a tunnel about 1000 feet long and a bore 28 feet 9 inches high on the center line. The roadway width in the tunnel is 42 feet and one sidewalk, 42 inches wide, is provided.

DIFFICULT CONSTRUCTION

The difficulties of construction of the four-lane Marin approach highway are not readily apparent. Mountainous highways have been built elsewhere, but have generally been limited

(Continued on page 17)



Waldo Approach looking down grade toward Richardson's Bay and junction of new road with State Highway at Waldo Point.



Interior view of State-built tunnel on mountain stretch of Marin approach to Golden Gate Bridge.



Finishing touches being put on section of new $2,000,000 State Highway leading to Golden Gate Bridge.

47 Bad Curves On Redwood Highway Being Eliminated

By J. W. VICKREY, District Engineer

TWO road reconstruction projects nearing completion in Mendocino County will eliminate a total of 47 curves, many of them dangerous, on the Redwood Highway between Outlet Creek and Reeves Creek, north of Willits, and between Eleven Oaks and Willits south of this city. Work on both improvements should be finished early this summer.

The first and larger project will do away with 2118 degrees of curvature embracing 36 curves, and 0.6 of a mile of length in a distance of 4.5 miles. The second has for its primary object the replacement of a narrow concrete bridge over Baechtel Creek in a right angle turn, and also calls for the elimination of ten other curves aggregating 270 degrees of curvature with a minimum radius of 150 feet in a distance of 1.1 miles.

The Outlet Creek-Reeves Creek job, located about three miles north of Willits, will cost approximately $200,000 and will replace on a modern standard the old Oil Well Hill grade which was constructed by the State in 1917. Previous to the first construction, the old county road, which was little better than a trail, carried the traffic in this locality.

HEAVY TRAFFIC INCREASE

It is a high compliment to the engineers involved that the 1917 construction carried traffic as well as it did for twenty years.

The tremendous increase in summer tourist traffic together with the advent of heavy slow moving trucks has, in later years, caused this section to be somewhat of a bottleneck.

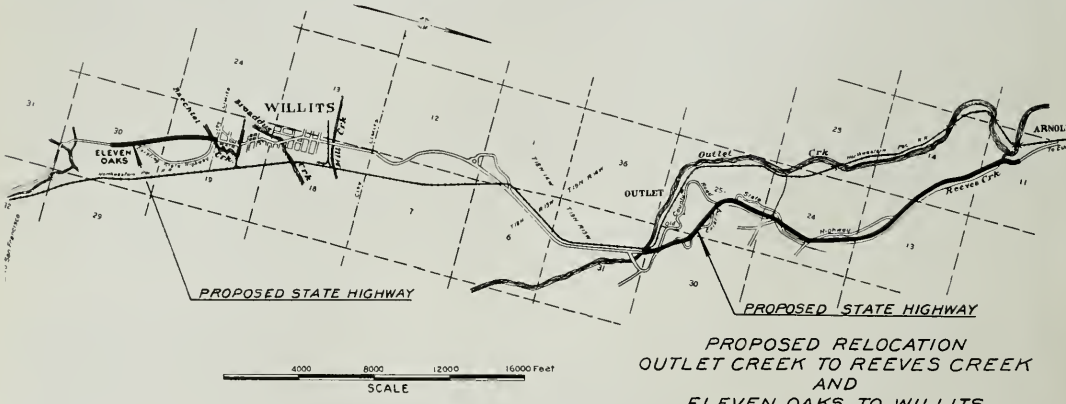
The sharp curves and heavy grade reduced the speed of trucks to such a point that the average driver who had the misfortune to be behind one of these trucks was faced with one of two alternatives; to stay where he was and enjoy the scenery at his leisure, or take the chance of passing where sight distance was poor. Impatience being a trait of the average driver, the second decision predominated, with the result that there were many accidents and several fatalities on this section.

The new location is very close to the old State highway and in general cuts through the points and across the canyons around which the original State highway was built. In the rough, steep terrain of the southerly half of the project, this has resulted in numerous heavy cuts and fills. The heaviest cut which is at the summit between Station 200 and Station 212, has a maximum depth of 93 feet and the new grade is about 50 feet lower than that of the old highway.

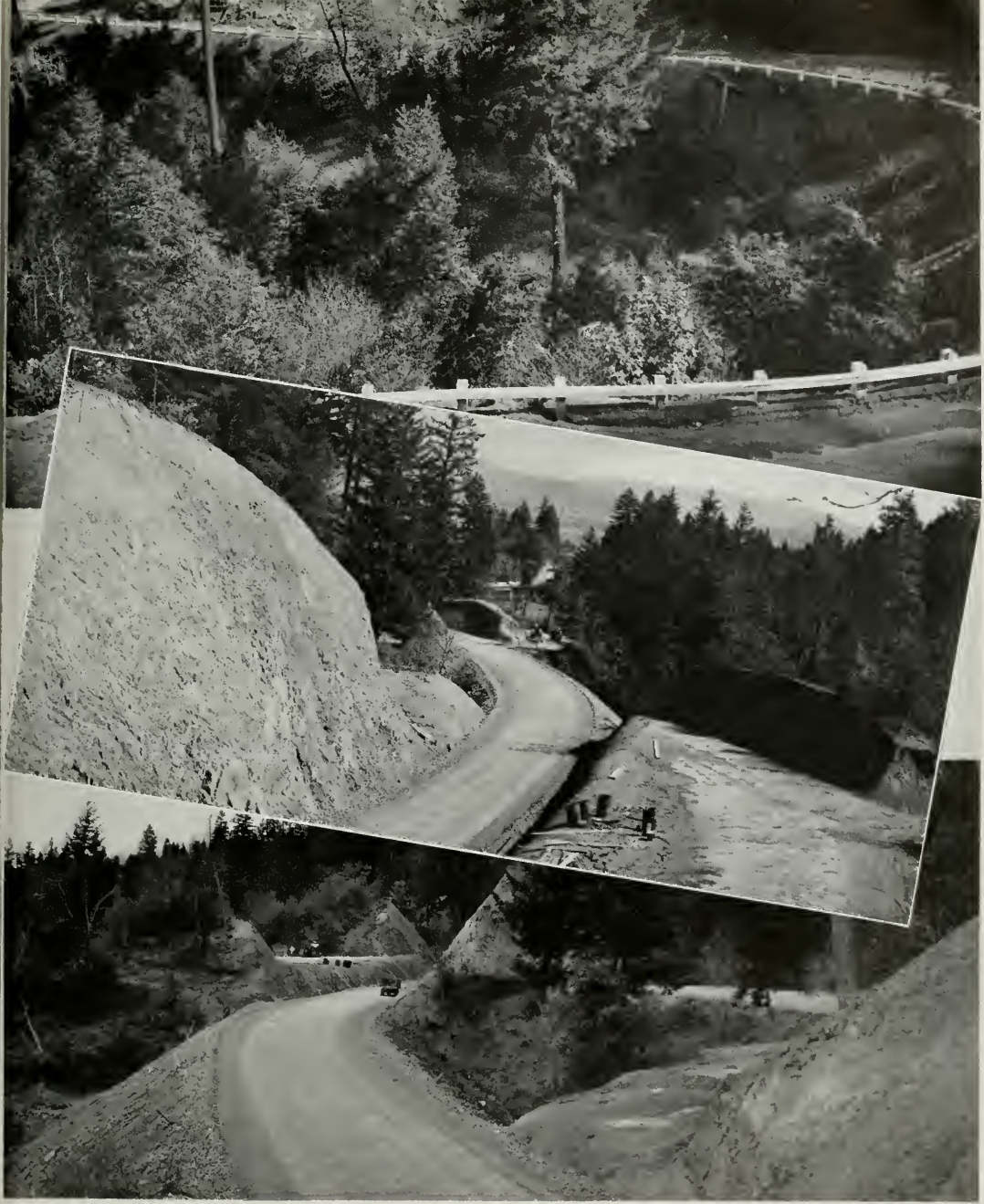
The original county road, the first State Highway construction and the construction now under way, all cross this summit at the same location and a striking contrast is presented between the trail-like remains of the county road and the present roadway 30 feet wide and nearly 100 feet lower.

From a construction standpoint the most interesting detail of the work is the typical cross-section of the improvement. This is designed for a roadbed 30 feet wide with no side ditches. The customary berms are provided on the low side of fills on curves. Drainage is taken care of by leading water down the surfaced edge of the road to frequent metal pipe culverts. Where these are placed in cut sections, drop inlets with cast steel

(Continued on page 20)



PROPOSED RELOCATION
OUTLET CREEK TO REEVES CREEK
AND
ELEVEN OAKS TO WILLITS



These pictures show sections of Redwood Highway in Mendocino County which are being standardized to eliminate dangerous curves. Upper: Section from Outlet Creek to Reeves Creek, showing crooked alignment of old road. Center: Outlet Creek to Reeves Creek, showing new alignment and bridge across Outlet Creek in distance. Lower: Another section of road on same project showing improved alignment.

Colorful Show Features Conejo Grade Dedication

By S. V. CORTELYOU, District Engineer

WITH pageantry and colorful ceremonies at 3:30 p.m. on Saturday, May 1, 1937, the $570,000 Conejo Grade realignment on the Ventura Route near Camarillo in Ventura County was officially opened to public traffic by Director of Public Works Earl Lee Kelly, acting for Governor Frank F. Merriam.

Director Kelly personally operated the huge power grader which pushed a boulder off the traveled way, symbolizing the removal of the last obstruction to traffic on this newly constructed highway. Immediately after removal of the boulder, long caravans of cars from both the Los Angeles and Ventura ends proceeded the length of the improvement, thus putting in service another great link of State Highway Route No. 2 (U. S. No. 101), and eliminating one of the most dangerous stretches of the old coast highway in its entire length.

OLD SPANISH SETTING

The day's festivities were commenced at noon in a large grove of fine old oak trees on the ranch of Adolpho Camarillo at the foot of the grade. At one of his famous barbecues Mr. Camarillo, scion of a California pioneer family, was the genial host to city, county and State officials and civic leaders and motion picture celebrities. The setting was that of the early Spanish days of California with Spanish musicians and dancers in costume entertaining the 350 guests. Leo Carrillo was master of ceremonies and entertained the gathering with his humor and anecdotes of early California times, while Adolpho Camarillo gave a most informative and interesting talk on the historical features of Conejo Pass.

Immediately following the barbecue, the gathering reassembled near the summit of the grade where a speakers' stand with public address system had been erected. Thousands of cars gathered at the barricades a short distance on each side of the stands and the occupants filled the highway and covered the surrounding hill overlooking the ceremonies. Music was furnished by the Ventura Junior College Band, the Ventura County Recreational Club Orchestra and the Oxnard Municipal Band.

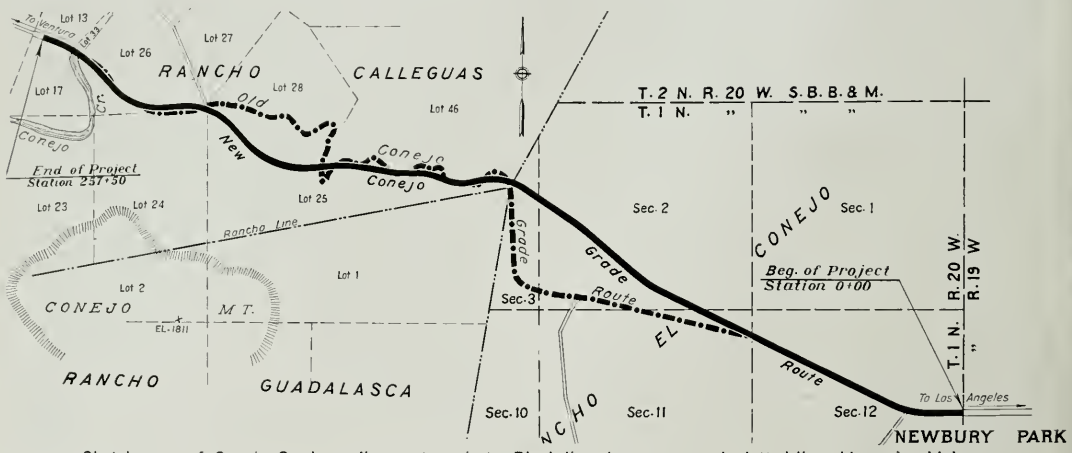
PICTURESQUE CAVALCADE

Presently there came into view around one of the curves, the Transportation Cavalcade sponsored by the California Mission Trails Association, Ltd., under the direction of C. M. C. Raymond, depicting progressively the modes of transportation in vogue in that country from the time the great Spanish explorer Portola first traveled on foot through Conejo Pass in 1669, to the streamlined automobile of 1937.

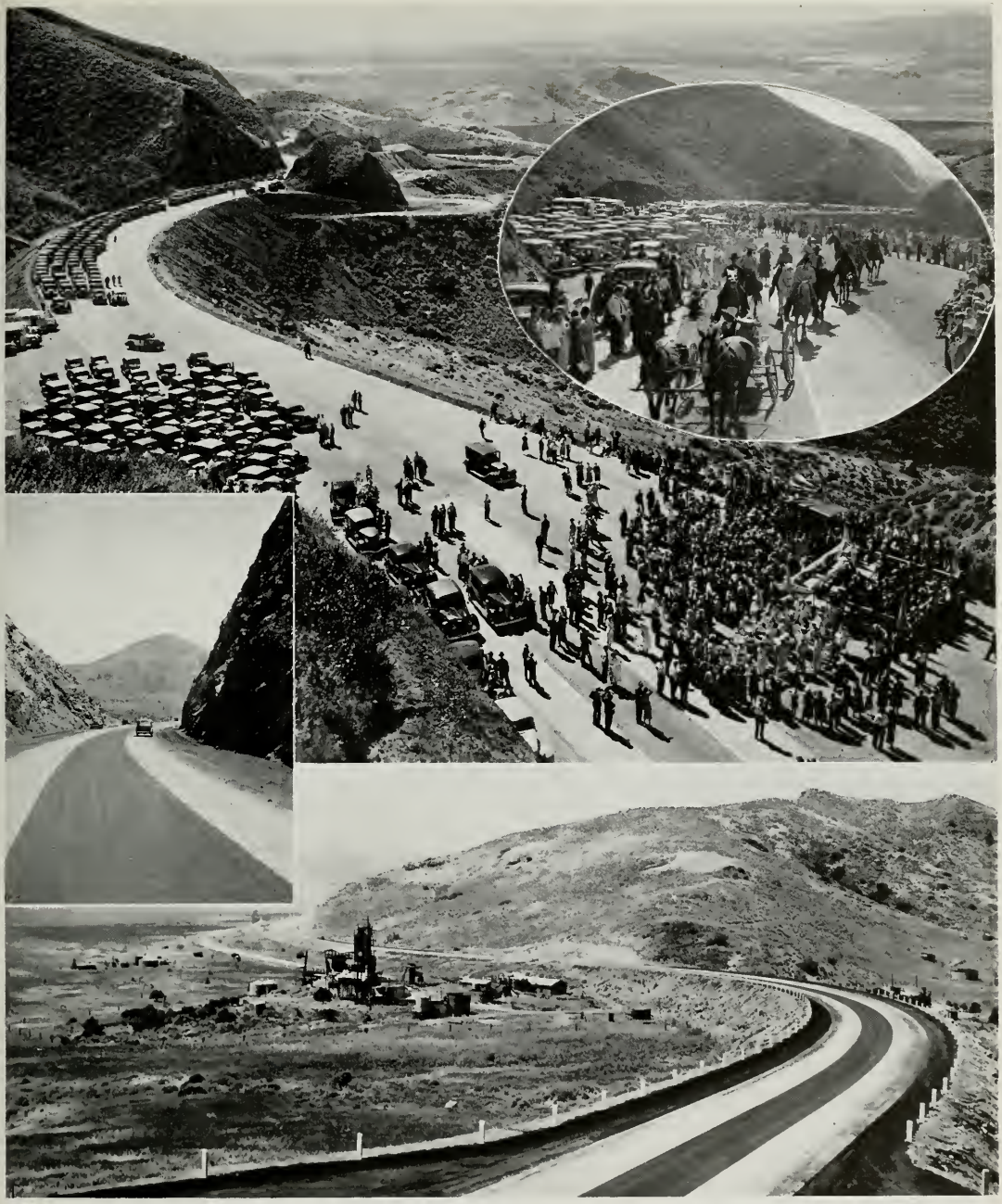
Adolpho Camarillo, the universally beloved pioneer of Ventura County, who donated the right of way for the changed alignment on Conejo Grade, in his capacity of President of the Camarillo Chamber of Commerce, acted as grand marshal of the cavalcade. Among his aides were Roy B. Witman and Leo Carrillo, all mounted on Mr. Camarillo's famous Arabian white horses.

Brown-robed Franciscan friars fol-

(Continued on page 20)



Sketch map of Conejo Grade realignment project. Black line shows new road; dotted line old curving highway.



Dedication of the new Conejo Grade was picturesque affair. Upper right: Portion of Transportation Pageant. Center: Scene during ceremonies showing new alignment and in middle distance old highway winding down grade. Left center: Section of completed road showing deep cut. Lower: At bottom of Conejo Grade showing new highway looking north toward Camarillo.

Charter Way Underpass In Stockton Opened To Traffic

By R. E. PIERCE, District Engineer

WITH Governor Frank F. Merriam and Director of Public Works Earl Lee Kelly as the principal speakers, ceremonies dedicating and opening to traffic the newly completed Charter Way Underpass in Stockton were held on Saturday morning, May 8.

San Joaquin County and city officials joined with representatives of the State administration and the Division of Highways in commemorating the occasion.

The need of safety on highways is of paramount importance in the building of roads, Governor Merriam said in a brief dedication address. He said that many highways are constructed at tremendous expense, but soon pay for themselves by cutting down mileage and making travel safer for motorists. He added that such highways can not be built in the future unless gasoline tax funds are zealously guarded and diversion of them to purposes other than highway construction and maintenance is prevented.

PROTECTING SCHOOL CHILDREN

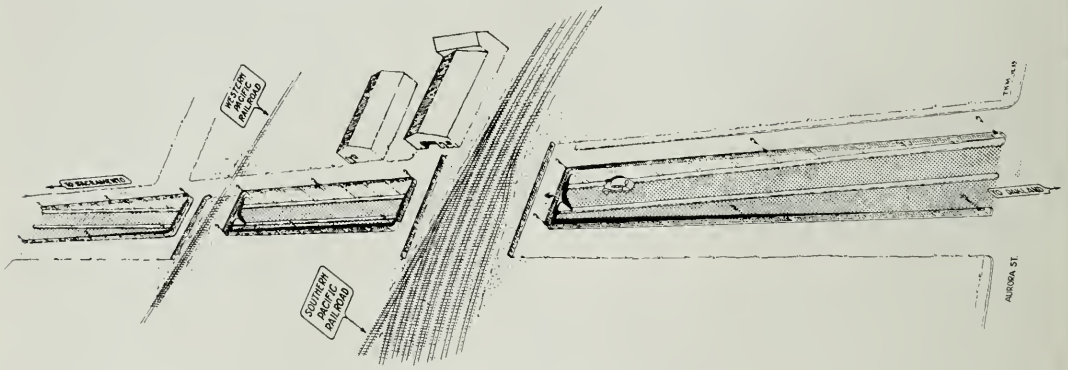
Director Kelly outlined the highway program of the Department of Public Works and said that the Division of Highways is committed to the policy of routing highways away from school buildings. More California school children were killed in highway accidents last year, he declared, than perishd in the Texas school building blast recently. He told of the plan to move the highway at Galt west of the high school and away from the business district as a safety measure for children.

Other speakers were Mayor Ralph W. Fay and C. P. Rendon. Three members of the California Highway Commission were present, P. A. Stanton of Anaheim, Paul Jasper of Fortuna, and William Hart of Carlsbad, as were Edward J. Neron, Deputy Director of the Department of Public Works, and State Adjutant General Harry H. Moorehead.

Following the dedication, the guests were entertained at a luncheon in the Hotel Wolf.

The underpass carries State highway traffic under the tracks of the Southern Pacific and the Western Pacific railroads on U. S. 50 in the southern part of the city of Stockton, and is an important relief to a large volume of traffic using this route.

Charter Way is in effect a by-pass to the business district of Stockton. Connecting as it does U. S. 99, east of the business district, the main route in the interior valley of California and the State highway running through Tracy to San Francisco via the Altamont Pass, it will serve a large volume of passenger traffic as well as the truck freight traffic originating southeast of Stockton and coming to the Port of Stockton, newly built and modernly equipped, serving a large number of ocean-going freighters.

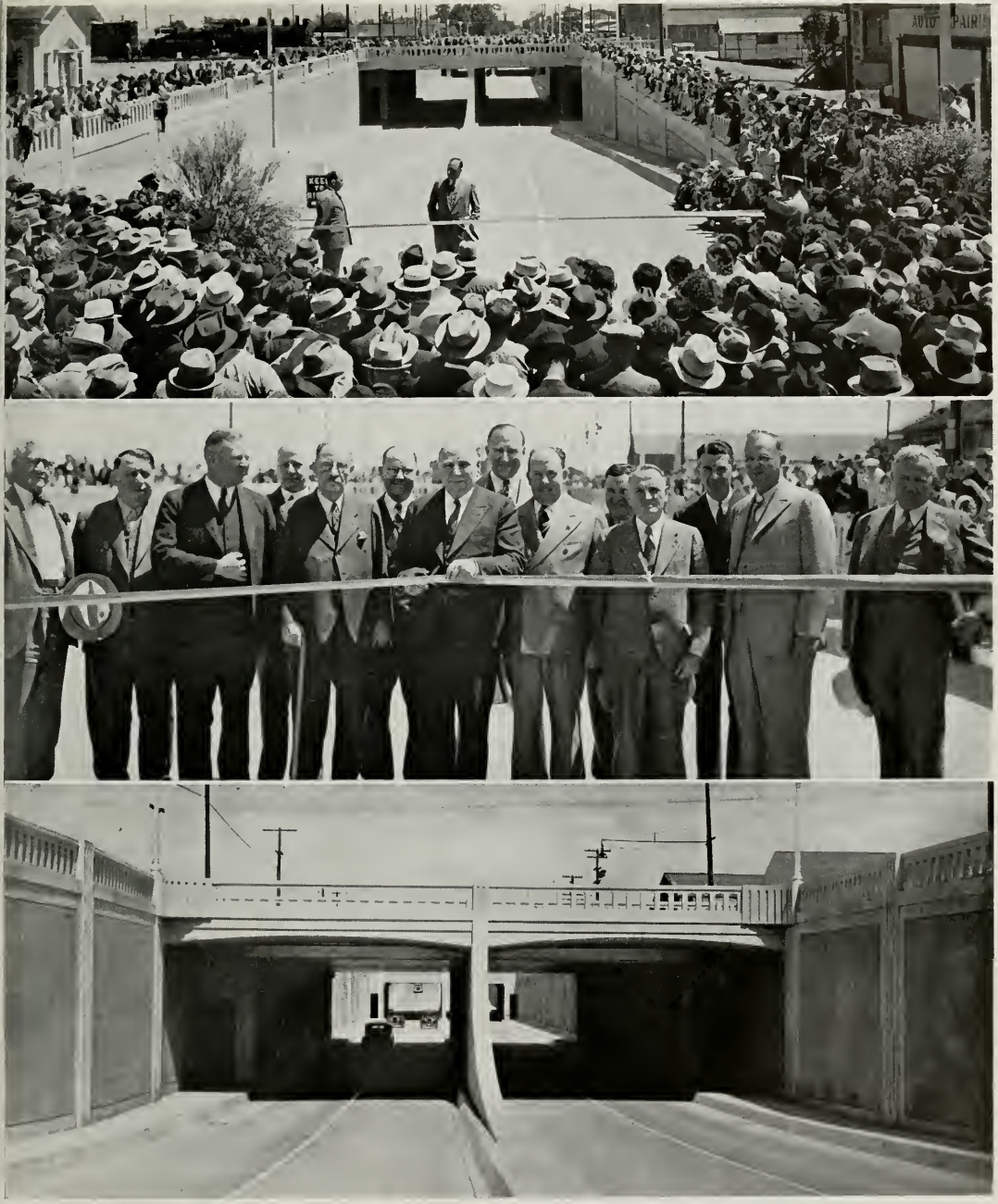


This sketch shows how Stockton grade separation project underpasses city streets and tracks of two railroads.

NEW UNDERPASS PLANNED

Prior to the completion of this underpass, traffic entering Stockton from the northeast, en route to points to the southwest preferred to cross Stockton via Miner Avenue on which is located a city-built underpass under the Southern Pacific and Western Pacific railroads, rather than take the chance of a delay in crossing these railroads at grade, on Charter Way, in spite of the congested city traffic that has to be traversed by the other route.

(Continued on page 27)



Scene at dedication of Charter Way Underpass in Stockton. Upper: Director of Public Works Earl Lee Kelly addressing dedication crowd before ceremony of ribbon cutting. Center: Left to right: C. P. Rendon, Louis Biasotti, District Highway Engineer R. E. Pierce, Adjutant General H. H. Moorehead, Highway Commissioner P. A. Stanton, Chas. H. Menzies, Governor Frank F. Merriam, Earl Lee Kelly, Mayor Ralph Fay, Al Biasotti, Highway Commissioner W. T. Hart, City Attorney Thomas Quinn, Highway Commissioner Paul Jasper, City Manager W. H. Hogan. Lower: Close-up view of underpass.

State-Wide Surveys Covering All Highway Uses and Trends

At the last annual convention of the American Association of State Highway Officials held in San Francisco, H. S. Fairbank, Chief, Division of Information, U. S. Bureau of Public Roads, delivered a talk on the objects and methods of the State-wide highway planning survey. California now is engaged in making its planning survey and the subject of Mr. Fairbank's address being still a timely one, the following excerpt from his discussion is printed.

By H. S. FAIRBANK, U.S. Bureau of Public Roads

FORTY States are now cooperating with the Bureau of Public Roads in State-wide highway planning surveys which cover the whole rural highway system and its urban connections. They include a road inventory, traffic surveys, and a financial study, coordinated to supply all the facts needed for intelligent planning of all the highways as essential parts of the transportation system of the whole country.

In our early highway planning we limited the State highway systems and the Federal Aid system to direct connections between important cities, which was sufficient to serve the greater portion of the motor vehicle traffic; and we adopted the "stage-construction" policy, which meant building or improving all of the selected system to a standard suitable for immediate needs, and as funds became more plentiful, raising these standards where necessary.

We have now practically completed the selected main highway systems, but largely because of the high speed of modern traffic many parts of the system are inadequate in grades, alignment, and width. Moreover there is a vast mileage of other roads which require improvement, but to what extent we do not know.

NEW TREND EVIDENT

Originally highways were built with funds from property taxes, but in recent years motor vehicle license fees and gasoline taxes have relieved property owners of that burden almost entirely. In fact, the need of revenue for other purposes during the depression inspired such raids on motor vehicle funds that a serious depletion of highway revenues was halted only by the Hayden-Cartwright Act.

Highway administration shows a new trend. Local authorities are yielding responsibility to State governments and the Federal Government. Shall the Federal Government assume full responsibility for a Federal system of highways?

The regulation and taxation of road use are problems. Interstate traffic is hampered by variable State laws. Commercial use of the roads is increasing. The altered relations of road to vehicle and of highway transport to other forms of transport arouse spirited controversies. Truck taxes have no definite relation to the loads carried, and other vehicle taxes have no rational basis.

REVERSING ECONOMIC PICTURE

Our people and our industries are located where they are largely because of the concentrative forces of railroads and steam power. Industry needed transportation, and needed coal to supply steam power, so cities were located on railroads. Farms, which depended on railroads and cities for markets, were valued according to their proximity to railroads. Highway transportation and widely distributed electric power, on the other hand, are diffusive. They are reversing the whole social and economic trend.

All these problems of highway planning must be solved on a basis of absolute facts. The objective of these surveys is to obtain such facts.

The inventory will reveal the actual mileage of our highways and the condition of their surfaces; sight distances, curvature and grades on main roads; and conditions at all railroad-highway grade crossings in rural territory. From the railroads and our traffic survey parties we shall obtain data on highway and rail traffic densities, accidents, and damage claims at each grade crossing.

PURPOSE OF SURVEYS

The inventory will show the location in rural territory of dwellings, buildings, and places of all kinds that are the origin and destination of highway traffic; roads used as mail routes; routes of school buses, common carrier buses and trucks; all railroads, routes of air lines, courses of navigable streams; and stations, ports, and wharves.

All these data will be classified in statistical tables and charted on large-scale maps.

The traffic surveys will show the flow of traffic over all the rural highways. Precise measurements of the weight and dimensions of various kinds and sizes of vehicles are being obtained, generally at pit scales, to provide data for use in solving problems of road design, taxation and regulation of vehicles.

CHARACTER OF DATA

One type of origin-and-destination study will show the range of movement over all roads, and the relative interest in the highways of city and county dwellers. Another, at locations where there are both free and toll facilities, will help us to measure the value that drivers put upon savings of time and distance. Still another will be made of highway routing.

(Continued on page 27)

Cities Share of Gas Tax for Present Biennial Period $13,311,614.74

(Continued from page 1)

,297,408 by annexations of unincorporated territories and by city incorporations, an increase of 31,644.

The 1935 Legislature under section 94 of the Streets and Highways Code provided for participation in the apportionment of cities incorporated subsequent to the 1930 Federal census and for annexations by cities of unincorporated territories. Calculation of such populations is determined by multiplying the number of registered electors residing therein by three.

Cities incorporated subsequent to 1930 are: Indio, Riverside County; Westmorland, Imperial County; Gardena, Los Angeles County; Fairfax, Marin County; Bay Shore, San Mateo County; Dos Palos, Merced County; and Tulelake, Siskiyou County. The latter city was incorporated March 1, 1937, and therefore is entitled to participate in the April, 1937, quarterly apportionment only.

The apportionment to cities by districts is as follows:

District I

CITY AND COUNTY	STREETS OF MAJOR IMPORTANCE Section 194 Fiscal Year Ending June 30 1936	STREETS OF MAJOR IMPORTANCE Section 194 Fiscal Year Ending June 30, 1937	STATE HIGHWAYS Section 203 Biennium Ending June 30, 1937
Del Norte County			
Crescent City	$1,028.98	$1,480.41	$2,823.88
Humboldt County			
Arcata	$1,022.40	$1,470.93	$2,805.79
Blue Lake	332.02	477.68	911.18
Eureka	9,423.59	13,557.72	25,861.34
Ferndale	531.85	765.16	1,459.55
Fortuna	741.23	1,066.41	2,034.16
Trinidad	64.01	92.10	175.67
Totals	$12,115.10	$17,430.00	$33,247.69
Lake County			
Lakeport	$788.49	$1,134.41	$2,163.88
Mendocino County			
Fort Bragg	$1,807.90	$2,601.03	$4,961.45
Point Arena	230.32	331.37	632.08
Ukiah	1,868.92	2,688.81	5,128.91
Willits	851.92	1,225.64	2,337.93
Totals	$4,759.06	$6,846.85	$13,060.37
Totals District I	$18,691.63	$26,891.67	$51,295.82

District II

Lassen County			
Susanville	$812.42	$1,168.83	$2,229.54
Modoc County			
Alturas	$1,398.71	$2,012.31	$3,838.49
Shasta County			
Redding	$2,505.45	$3,604.61	$6,875.78
Siskiyou County			
Dorris	$455.86	$655.85	$1,251.03
Dunsmuir	1,561.42	2,246.43	4,285.04
Etna	226.74	326.20	622.23
Fort Jones	180.67	259.93	495.82
Montague	303.31	436.38	832.40
Mt. Shasta	603.62	868.44	1,656.54
Tulelake	------	61.10	61.10
Yreka	1,316.75	1,894.39	3,599.90
Totals	$4,648.37	$6,748.72	$12,804.06
Tehama County			
Corning	$823.79	$1,185.18	$2,260.74
Red Bluff	2,104.04	3,027.08	5,774.15
Tehama	113.66	163.53	311.93
Totals	$3,041.49	$4,375.79	$8,346.82
Totals District II	$12,406.44	$17,910.26	$34,094.69

District III

CITY AND COUNTY	STREETS OF MAJOR IMPORTANCE Section 194 Fiscal Year Ending June 30 1936	STREETS OF MAJOR IMPORTANCE Section 194 Fiscal Year Ending June 30, 1937	STATE HIGHWAYS Section 203 Biennium Ending June 30, 1937
Butte County			
Biggs	$276.99	$398.50	$760.14
Chico	4,762.65	6,852.02	13,070.24
Gridley	1,161.19	1,670.62	3,186.69
Oroville	2,212.33	3,182.86	6,071.31
Totals	$8,413.16	$12,104.00	$23,088.38
Colusa County			
Colusa	$1,265.89	$1,821.24	$3,474.01
Williams	509.10	736.12	1,400.82
Totals	$1,774.99	$2,557.36	$4,874.83
El Dorado County			
Placerville	$1,389.13	$2,037.28	$3,850.95
Glenn County			
Orland	$714.91	$1,028.53	$1,961.93
Willows	1,210.85	1,742.05	3,322.95
Totals	$1,925.76	$2,770.58	$5,284.88
Nevada County			
Grass Valley	$2,283.50	$3,285.28	$6,266.67
Nevada City	1,017.62	1,464.05	2,792.68
Totals	$3,301.12	$4,749.33	$9,059.35
Placer County			
Auburn	$1,591.94	$2,290.31	$4,368.78
Colfax	545.60	784.97	1,497.32
Lincoln	1,252.73	1,802.30	3,437.89
Rocklin	433.13	623.16	1,188.65
Roseville	3,843.74	5,529.98	10,548.44
Totals	$7,667.14	$11,030.72	$21,041.08
Sacramento County			
North Sacramento	$1,254.53	$1,804.88	$3,442.83
Sacramento	56,085.65	80,690.48	153,916.99
Totals	$57,340.18	$82,495.36	$157,359.82
Sierra County			
Loyalton	$500.73	$720.41	$1,374.18
Sutter County			
Yuba City	$2,156.68	$3,102.82	$5,918.62
Yolo County			
Davis	$743.63	$1,069.85	$2,040.74
Winters	536.02	771.17	1,471.02
Woodland	3,331.64	4,793.23	9,138.15
Totals	$4,611.29	$6,634.25	$12,649.91

Gasoline Tax Apportionment to the C

District III—Continued

CITY AND COUNTY	STREETS OF MAJOR IMPORTANCE Section 194 Fiscal Year Ending June 30, 1936	STREETS OF MAJOR IMPORTANCE Section 194 Fiscal Year Ending June 30, 1937	STATE HIGHWAYS Section 203 Biennium Ending June 30, 1937
Yuba County			
Marysville	$3,447.70	$4,960.21	$9,461.60
Wheatland	286.55	412.27	786.39
Totals	$3,734.25	$5,372.48	$10,247.99
Totals District III	$92,814.43	$133,574.59	$254,749.99

District IV

Alameda County			
Alameda	$20,958.38	$30,152,85	$57,516.52
Albany	5,126.38	7,375.33	14,068.42
Berkeley	49,121.47	70,671.09	134,805.03
Emeryville	1,397.51	2,010.59	3,835.20
Hayward	3,308.31	4,759.66	9,079.05
Livermore	1,865.93	2,684.52	5,120.73
Oakland	169,939.83	244,492.56	466,369.31
Piedmont	5,583.44	8,032.90	15,322.75
Pleasanton	740.03	1,064.69	2,030.88
San Leandro	6,852.91	9,859.30	18,806.59
Totals	$264,894.19	$381,103.49	$726,954.48
Contra Costa County			
Antioch	$2,696.90	$3,880.03	$7,228.93
Concord	673.03	968.29	1,847.00
El Cerrito	2,315.22	3,330.91	6,353.70
Hercules	234.51	337.39	643.57
Martinez	4,073.46	5,860.49	11,135.15
Pinole	467.23	672.22	1,282.24
Pittsburg	5,749.16	8,271.30	15,777.52
Richmond	12,020.58	17,313.56	33,007.85
Walnut Creeek	606.62	872.75	1,664.77
Totals	$28,836.71	$41,506.94	$78,940.73
Marin County			
Belvedere	$299.12	$430.34	$820.88
Corte Madera	614.40	883.95	1,686.11
Fairfax	1,749.88	2,517.54	4,802.21
Larkspur	742.43	1,068.12	2,037.45
Mill Valley	2,491.10	3,583.94	6,836.37
Ross	810.63	1,166.25	2,224.61
San Anselmo	2,781.84	4,002.26	7,634.29
San Rafael	4,799.14	6,904.52	13,170.38
Sausalito	2,193.77	3,156.18	6,020.42
Totals	$16,482.31	$23,713.10	$45,232.72
Napa County			
Calistoga	$598.25	$860.70	$1,641.78
Napa	3,850.91	5,540.32	10,568.14
St. Helena	946.42	1,361.62	2,597.30
Totals	$5,395.58	$7,762.64	$14,807.22
San Francisco County			
San Francisco	$379,524.29	$546,021.91	$1,041,536.18
San Mateo County			
Atherton	$792.08	$1,139.56	$2,173.71
Bay Shore	687.39	988.95	1,886.42
Belmont	597.65	859.84	1,637.41
Burlingame	7,938.73	11,421.45	21,786.41
Daly City	5,046.21	7,260.00	13,739.63
Hillsborough	1,131.29	1,627.58	3,104.61
Lawndale	220.75	317.60	605.83
Menlo Park	1,348.44	1,940.01	3,700.56
Redwood City	5,361.49	7,713.58	14,713.65

District IV—Continued

CITY AND COUNTY	STREETS OF MAJOR IMPORTANCE Section 194 Fiscal Year Ending June 30, 1936	STREETS OF MAJOR IMPORTANCE Section 194 Fiscal Year Ending June 30, 1937	STATE HIGHWAYS Section 203 Biennium Ending June 30,1937
San Bruno	$2,159.68	$3,107.12	$5,926.84
San Carlos	677.22	974.31	1,858.50
San Mateo	8,050.01	11,581.56	22,089.62
So. San Francisco	3,704.94	5,330.31	10,167.55
Totals	$37,715.88	$54,261.87	$103,390.74
Santa Clara County			
Alviso	$227.93	$327.92	$625.50
Gilroy	2,095.06	3,014.17	5,749.52
Los Gatos	1,895.25	2,726.70	5,201.19
Morgan Hill	543.21	781.52	1,490.75
Mountain View	1,979.00	2,847.19	5,431.01
Palo Alto	8,199.28	11.907.76	22,603.11
San Jose	37,104.47	53,382.24	101,789.38
Santa Clara	3,770.16	5,424.13	10,346.52
Sunnyvale	1,850.97	2,662.99	5,079.65
Totals	$57,665.33	$83,074.62	$158,316.63
Santa Cruz County			
Santa Cruz	$8,611.77	$12,389.75	$23,633.45
Watsonville	5,169.45	7,437.29	14,132.50
Totals	$13,781.22	$19,827.04	$37,765.95
Sonoma County			
Cloverdale	$454.06	$653.28	$1,246.10
Healdsburg	1,373.58	1,976.16	3,769.54
Petaluma	4,932.55	7,096.45	13,536.49
Santa Rosa	6,362.95	9,154.38	17,461.97
Sebastopol	1,054.11	1,516.55	2,892.82
Sonoma	586.29	843.49	1,608.96
Totals	$14,763.54	$21,240.31	$40,515.88
Totals District IV	$819,059.05	$1,178,511.92	$2,247,460.53

District V

Monterey County			
Carmel	$1,352.03	$1,945.18	$3,710.42
King City	887.20	1,276.41	2,434.76
Monterey	5,468.58	7,867.65	15,007.53
Pacific Grove	3,325.05	4,783.76	9,125.02
Salinas	6,260.06	9,006.35	17,142.96
Soledad	355.36	511.26	975.22
Totals	$17,648.28	$25,390.61	$48,395.91
San Benito County			
Hollister	$2,247.62	$3,233.65	$6,168.18
San Juan Bautista	461.84	664.46	1,267.45
Totals	$2,709.46	$3,898.11	$7,435.63
San Luis Obispo County			
Arroyo Grande	$533.63	$767.74	$1,464.46
Paso Robles	1,539.29	2,214.57	4,224.30
San Luis Obispo	4,951.10	7,123.14	13,587.39
Totals	$7,024.02	$10,105.45	$19,276.15
Santa Barbara County			
Lompoc	$1,702.01	$2,448.70	$4,670.88
Santa Barbara	20,108.88	28,930.65	55,185.19
Santa Maria	4,221.83	6,073.94	11,586.04
Totals	$26,032.72	$37,453.29	$71,442.11
Totals District V	$53,414.48	$76,847.46	$146,549.80

...es for Biennium Ending June 30, 1937

Property of State Highway Library

District VI

CITY AND COUNTY	STREETS OF MAJOR IMPORTANCE Section 194 Fiscal Year Ending June 30, 1936	STREETS OF MAJOR IMPORTANCE Section 194 Fiscal Year Ending June 30, 1937	STATE HIGHWAYS Section 203 Biennium Ending June 30, 1937
Fresno County			
Coalinga	$1,705.59	$2,453.84	$4,680.70
Clovis	787.30	1,132.68	2,160.58
Firebaugh	302.72	435.52	830.75
Fowler	700.55	1,007.88	1,922.53
Fresno	31,424.71	45,219.92	86,245.90
Kingsburg	790.89	1,137.85	2,170.45
Parlier	337.41	485.44	925.97
Reedley	1,548.86	2,228.35	4,250.57
Sanger	1,774.99	2,553.70	4,871.16
San Joaquin	97.52	140.29	267.61
Selma	1,822.86	2,622.55	5,002.52
Totals	$41,293.40	$59,418.02	$113,328.74
Kern County			
Bakersfield	$15,563.39	$22,391.07	$42,710.95
Delano	1,574.59	2,265.36	4,321.17
Maricopa	640.72	921.81	1,758.34
Taft	2,059.17	2,962.52	5,651.01
Tehachapi	440.31	633.47	1,208.35
Totals	$20,278.18	$29,174.23	$55,649.82
Kings County			
Corcoran	$1,057.71	$1,521.72	$2,902.67
Hanford	4,204.47	6,048.98	11,538.42
Lemoore	836.94	1,204.12	2,296.86
Totals	$6,099.12	$8,774.82	$16,737.95
Madera County			
Chowchilla	$506.71	$729.01	$1,390.58
Madera	2,790.83	4,015.16	7,658.93
Totals	$3,297.54	$4,744.17	$9,049.51
Tulare County			
Dinuba	$1,775.61	$2,554.55	$4,872.81
Exeter	1,606.29	2,310.98	4,408.19
Lindsay	2,320.00	3,337.79	6,366.82
Porterville	3,172.50	4,564.29	8,706.37
Tulare	3,713.32	5,342.36	10,190.55
Visalia	4,345.06	6,251.24	11,924.24
Totals	$16,932.78	$24,361.21	$46,468.98
Totals District VI	$87,901.02	$126,472.45	$241,235.00

District VII

CITY AND COUNTY	STREETS OF MAJOR IMPORTANCE Section 194 Fiscal Year Ending June 30, 1936	STREETS OF MAJOR IMPORTANCE Section 194 Fiscal Year Ending June 30, 1937	STATE HIGHWAYS Section 203 Biennium Ending June 30, 1937
Los Angeles County			
Alhambra	$17,631.53	$25,366.51	$48,386.57
Arcadia	3,120.45	4,489.40	8,563.51
Avalon	1,134.88	1,632.75	3,114.48
Azusa	2,876.37	4,138.24	7,893.69
Bell	4,716.57	6,785.75	12,943.81
Beverly Hills	10,426.85	15,001.11	28,614.60
Burbank	9,967.99	14,340.95	27,355.35
Compton	7,487.66	10,772.51	20,548.54
Covina	1,659.54	2,387.57	4,554.28
Culver City	3,391.47	4,879.30	9,307.26
Claremont	1,626.63	2,340.24	4,464.01
El Monte	2,081.31	2,994.36	5,711.77
El Segundo	2,095.66	3,015.03	5,751.17
Gardena	4,214.05	6,062.76	11,564.70
Glendale	37,531.62	53,996.77	102,998.79
Glendora	1,651.76	2,376.39	4,532.96
Hawthorne	3,946.04	5,677.17	10,829.19
Hermosa Beach	2,869.20	4,127.91	7,873.98

District VII—Continued

CITY AND COUNTY	STREETS OF MAJOR IMPORTANCE Section 194 Fiscal Year Ending June 30, 1936	STREETS OF MAJOR IMPORTANCE Section 194 Fiscal Year Ending June 30, 1937	STATE HIGHWAYS Section 203 Biennium Ending June 30, 1937
Huntington Park	$14,711.49	$21,165.43	$40,373.04
Inglewood	12,815.04	18,437.02	34,814.85
La Verne	1,710.99	2,461.60	4,695.50
Long Beach	85,280.70	122,693.42	233,942.98
Los Angeles	742,170.24	1,067,760.93	2,036,713.43
Lynwood	4,380.97	6,302.91	12,022.78
Manhattan Beach	1,131.29	1,627.58	3,104.61
Maywood	4,064.49	5,847.59	11,154.25
Monrovia	6,514.90	9,373.00	17,878.99
Montebello	3,289.17	4,732.12	9,026.52
Monterey Park	3,832.36	5,513.64	10,517.25
Pasadena	45,658.20	65,711.44	125,281.03
Pomona	12,445.93	17,905.97	34,155.61
Redondo Beach	5,591.83	8,044.95	15,345.73
San Fernando	4,526.93	6,512.90	12,423.36
San Gabriel	4,366.61	6,282.24	11,969.70
San Marino	2,231.46	3,210.40	6,123.84
Santa Monica	22,222.48	31,971.50	60,985.60
Sierra Madre	2,123.77	3,055.48	5,828.33
Signal Hill	1,754.06	2,523.57	4,813.71
South Gate	11,744.79	16,897.24	32,231.46
South Pasadena	8,213.93	11,817.38	22,541.65
Torrance	5,284.91	7,603.41	14,218.65
Vernon	759.18	1,092.23	2,083.43
West Covina	549.79	790.98	1,481.47
Whittier	8,867.22	12,767.35	24,344.56
Totals	$1,134,672.31	$1,632,487.00	$3,113,080.99
Orange County			
Anaheim	$6,588.50	$9,478.87	$18,077.67
Brea	1,456.73	2,095.80	3,997.74
Fullerton	6,496.96	9,347.18	17,829.75
Huntington Beach	2,207.53	3,175.97	6,058.16
Laguna Beach	1,185.13	1,705.04	3,252.36
La Habra	1,359.82	1,956.37	3,731.77
Newport Beach	1,317.95	1,896.12	3,616.85
Orange	4,825.45	6,942.40	13,242.61
Placentia	960.78	1,382.29	2,636.70
San Clemente	399.03	574.08	1,095.06
Santa Ana	18,140.04	26,098.10	49,782.09
Seal Beach	691.57	994.96	1,897.88
Tustin	553.98	797.01	1,520.30
Totals	$46,183.47	$66,444.19	$126,738.94
Ventura County			
Fillmore	$1,730.73	$2,490.00	$4,749.68
Ojai	878.23	1,263.51	2,410.13
Oxnard	3,759.98	5,409.49	10,318.59
Santa Paula	4,458.13	6,413.92	12,234.56
Ventura	6,941.46	9,986.68	19,049.58
Totals	$17,768.53	$25,563.60	$48,762.54
Totals District VII	$1,198,624.31	$1,724,494.79	$3,288,582.47

District VIII

CITY AND COUNTY	STREETS OF MAJOR IMPORTANCE Section 194 Fiscal Year Ending June 30, 1936	STREETS OF MAJOR IMPORTANCE Section 194 Fiscal Year Ending June 30, 1937	STATE HIGHWAYS Section 203 Biennium Ending June 30, 1937
Riverside County			
Banning	$1,646.38	$2,374.94	$4,524.48
Beaumont	796.87	1,146.45	2,186.85
Corona	4,198.50	6,040.38	11,522.02
Elsinore	807.63	1,161.95	2,216.41
Hemet	1,337.08	1,923.66	3,669.37
Perris	456.46	656.71	1,252.67
Riverside	17,765.55	25,559.29	48,754.35
San Jacinto	805.23	1,158.50	2,209.83
Totals	$27,813.70	$40,021.88	$76,335.98

District VIII—Continued

CITY AND COUNTY	STREETS OF MAJOR IMPORTANCE Section 194 Fiscal Year Ending June 30, 1936	STREETS OF MAJOR IMPORTANCE Section 194 Fiscal Year Ending June 30, 1937	STATE HIGHWAYS Section 203 Biennium Ending June 30,1937
San Bernardino County			
Chino	$1,865.33	$2,683.66	$5,119.08
Colton	4,794.35	6,897.63	13,157.23
Needles	1,880.89	2,706.04	5,161.75
Ontario	8,125.99	11,690.86	22,300.32
Redlands	8,481.35	12,202.12	23,275.54
Rialto	982.32	1,413.28	2,695.81
San Bernardino	23,149.77	33,544.47	63,547.83
Upland	2,819.53	4,056.48	7,737.72
Totals	$52,099.53	$75,194.54	$142,995.28
Totals District VIII	$79,913.23	$115,216.42	$219,331,26

District IX

Inyo County			
Bishop	$693.37	$997.55	$1,902.82
Totals District IX	$693.37	$997.55	$1,902.82

District X

Amador			
Amador City	$102.31	$147.18	$280.74
Jackson	1,199.49	1,725.70	3,291.78
Plymouth	205.20	295.22	563.13
Sutter Creek	606.01	871.89	1,663.12
Totals	$2,113.01	$3,039.99	$5,798.77
Calaveras County			
Angels	$547.40	$787.55	$1,502.25
Mariposa County			
Hornitos	$37.09	$53.37	$101.79
Merced County			
Atwater	$548.59	$789.26	$1,505.52
Dos Palos	556.37	800.45	1,357.37
Gustine	607.82	874.47	1,668.05
Livingston	480.39	691.15	1,318.36
Los Banos	1,121.71	1,613.81	3,078.34
Merced	4,227.22	6,081.69	11,600.82
Totals	$7,542.10	$10,850.83	$20,528.46
Sacramento County			
Isleton	$1,738.51	$2,501.19	$4,622.31
San Joaquin			
Lodi	$4,060.90	$5,942.02	$11,244.02
Manteca	965.56	1,389.16	2,649.82
Stockton	28,693.73	41,281.67	78,744.75
Tracy	2,290.69	3,295.61	6,286.37
Totals	$36,010.88	$51,908.46	$98,924.96

District X—Continued

CITY AND COUNTY	STREETS OF MAJOR IMPORTANCE Section 194 Fiscal Year Ending June 30, 1936	STREETS OF MAJOR IMPORTANCE Section 194 Fiscal Year Ending June 30, 1937	STATE HIGHWAYS Section 203 Biennium Ending June 30, 1937
Solano County			
Benicia	$1,742.69	$2.507.21	$4,782.50
Dixon	598.24	860.71	1,641.78
Fairfield	676.62	973.45	1,856.86
Rio Vista	783.10	1,126.65	2,149.09
Suisun	541.42	778.93	1,485.81
Vacaville	930.87	1,339.25	2,554.61
Vallejo	8,800.31	13,148.88	24,595.94
Totals	$14,073.25	$20,735.08	$39,066.59
Stanislaus County			
Ceres	$586.88	$844.34	$1,610.58
Modesto	8,291.70	11,929.28	22,751.80
Newman	759.18	1,092.22	2,083.43
Oakdale	1,263.50	1,817.80	3,467.45
Patterson	541.43	778.93	1,485.83
Riverbank	480.39	691.14	1,318.34
Turlock	2,558.09	3,680.35	7,020.25
Totals	$14,481.17	$20,834.06	$39,737.68
Tuolumne County			
Sonora	$1,362.80	$1,960.67	$3,739.97
Totals District X	$77,906.21	$112,671.20	$214,022.78

District XI

Imperial County			
Brawley	$6,245.10	$8,984.83	$17,138.55
Calexico	3,768.36	5,421.54	10,341.58
Calipatria	929.67	1,337.52	2,551.33
El Centro	5,045.62	7,259.13	13,846.78
Holtville	1,051.72	1,513.11	2,886.26
Imperial	1,162,39	1,672.34	3,189.98
Westmorland	883.02	1,270.38	2,423.27
Totals	$19,085.88	$27,458.85	$52,377.75
Riverside County			
Blythe	$610.21	$877.91	$1,674.61
Indio	1,556.04	2,238.69	4,270.28
Totals	$2,166.25	$3,116.60	$5,944.89
San Diego County			
Chula Vista	$2,314.61	$3,330.05	$6,352.04
Coronado	3,245.49	4,669.28	8,906.67
El Cajon	628.16	903.73	1,723.87
Escondido	2,046.60	2,944.45	5,616.54
La Mesa	1,503.40	2,162.94	4,125.80
National City	4,367.80	6,283.96	11,986.64
Oceanside	2,102.24	3,024.49	5,768.13
San Diego	88,539.36	129,541.22	245,139.41
Totals	$104,747.66	$152,860.12	$289,619.10
Totals District XI	$125,999.79	$183,435.57	$347,941.74

Autos Add to Realty Values

Motor vehicles are directly responsible for 5.35 per cent of urban real estate tax revenues, it is indicated in a survey made by the Bureau of Business Research of Boston University. The bureau, selecting the town of Winchester, Mass., with 12,719 population, found that assessments on buildings totaled $603,450 in 1935, of which $32,291, or 5.35 per cent, was tax receipts from public and private garages, filling stations, and automobile sales rooms.

The bureau did not consider land values in its survey. It is believed that had it done so the percentage of real estate taxes derived from motor vehicles would probably have been larger, for driveways and garages occupy from one-quarter to one-third of the land in residential communities.

"Hoskins, the cook advises me that you were badly intoxicated last night and that you were trying to roll a barrel out of the basement. Can this be true?"

"Yes, my lord."

"And where was I during this time?"

"In the barrel, my lord."

Fiesta Celebration Will Mark Golden Gate Bridge Opening

(Continued from page 2)

Highway District. They are San Francisco, Marin, Sonoma, Napa, Mendocino and Del Norte.

Finally the completed plans for the bridge were submitted by Chief Engineer Joseph B. Strauss and adopted by the district directors, who proposed a bond election after the engineer had assured them that the project could be completed within a cost of thirty-five million dollars.

DRILL THROUGH SOLID ROCK

The most difficult part of the project centered about erection of the south pier, located in the open seaway off Fort Winfield Scott.

Diamond drill borings had indicated a solid rock foundation, but the hardness of this rock was not appreciated until the work of excavation was commenced. This work involved the use of specially designed high explosive bombs, which were driven into the rock bottom, then detonated.

First an area of approximately an acre had to be leveled off. Then it was necessary to go down into the rock an average depth of 35 feet to provide suitable footings for the pier.

The job required months of arduous labor, some during the winter, when workers were forced to perform their tasks as seas and chilling winds beat against them.

While this work was under way, the north pier on the Marin shore at Lime Point had been completed and the mighty 746-foot steel tower erected on it.

When the towers were completed, work on the concrete and steel anchorages at either side of the Golden Gate had progressed to the point where they were in readiness to receive the parallel wire cables, each 36½ inches in diameter, the largest suspension bridge cables in the history of this type of construction.

The anchorage blocks, huge concrete monoliths, in which are imbedded steel reinforcing bars and the eye-bars, to which the cables are attached, each weigh approximately 64,000 tons and each is so designed that the weight of the bridge structure upon it exerts its pull against the solid rock in which it is imbedded.

This pull at each anchorage is 63,000,000 pounds, or half what the anchorages are capable of supporting.

Between the anchorages and towers the cables are supported by pylons, through which they run.

SIX HIGHWAY LANES

On the north side the pylons are part of the anchorage structure, but on the south side the pylons are distinct structures, between which a gigantic arch spans Fort Winfield Scott, making the preservation of this historic structure possible.

The cable construction, which required the use of more than 80,000 miles of specially-drawn, galvanized steel wire—sufficient to encircle the earth three and one-half times, was let to the John A. Roeblings' Sons Company, builders of the Brooklyn Bridge and contractors for the cable erection on the George Washington Bridge.

The Bethlehem Steel Company erected the suspended structure and last November the two sections built out from each tower joined each other at the center of the span.

The completed Golden Gate Bridge has six highway traffic lanes, flanked on either side by 10½-foot sidewalks for pedestrian traffic.

EARTHQUAKE PROOF

As in the case of the San Francisco-Oakland Bay Bridge the possible effect of earthquakes was thoroughly considered in designing the Golden Gate Bridge, which its engineers declare is constructed to withstand a far more serious earthquake shock than ever has been known in this or any other area.

At the same time wind pressures were taken into account during the designing of the span, which has a safety factor of 2.6 at a wind velocity of 90 miles an hour. The greatest recorded wind velocity at the Golden Gate is 58 miles.

Expansion and contraction of the long steel span also is amply provided for, so that the bridge may raise or lower itself 16 feet as influenced by heat or cold.

Unlike the San Francisco-Oakland Bay Bridge, the Golden Gate Bridge,

Waldo Approach Is State's Share of Gate Bridge

(Continued from page 4)

to two traffic lane capacity, due to combined light travel and prohibitive construction costs. This particular area, however, is so shaken by earthquakes of the past and is located so close to a major earthquake fault, that the disturbance of its present equilibrium with the heavy cuts and fills required, provides unpredictable damage from slides.

Provision for stable foundations for the heavy fills required removal of soft material to depths of as much as forty feet, with rock backfill and other special drainage provisions.

It is probable that this section of highway will not become fully stabilized for a number of years to come, but the achievement in opening it to traffic with the Golden Gate Bridge is one of the remarkable features of the project as a whole.

The construction of this northerly approach to the bridge is one of the largest single projects for road construction entered into by the Division of Highways. The yardage of roadway excavation was estimated originally at 1,813,000 cubic yards, with anticipated slides set as a variable quantity. The anticipation that slides would develop into a serious problem has been borne out by the fact that by April 1, with construction only about 85 per cent complete, slides had increased material removal to the point that a total of more than 2,500,000 cubic yards of roadway excavation had been moved.

The unusual size of the project is also shown by the fact that the work included over 50,000 cubic yards of tunnel excavation, 436,000 pounds of reinforcing steel, 1,000,000 pounds of structural steel and over 21,000 lineal feet of corrugated metal culverts and underdrains.

while of a public nature, is not a State project. It has been built and will be operated, until such time as it is made toll free, by the Golden Gate Bridge and Highway District, a subdivision of the six counties of San Francisco, Marin, Sonoma, Napa, Mendocino and Del Norte.

Completion of Manchester Blvd. Fruition of 13 Years of Effort

By JULIEN D. ROUSSEL
Secretary, California Highway Commission

THE last unit of the Manchester Boulevard Route, (State Highway Route No. 174) was formally dedicated for public use by Highway Commissioner P. A. Stanton and Director of Public Works Earl Lee Kelly at Anaheim on Friday, April 30th.

This route extends easterly from State Route No. 60 in Los Angeles County at Playa del Rey, through the cities of Inglewood, Los Angeles and South Gate, thence southeasterly in a direct line through the communities of Downey, Norwalk and Buena Park, and through the southwesterly corner of the city of Aneheim, connecting with State Route 2 (U. S. 101) in Orange County at Miraflores, and makes a total distance of 33.01 miles.

The opening ceremony was held at the intersection of Manchester Boulevard and Broadway in the city of Anaheim. Caravans from other cities met at the scene of the dedication. After musical numbers by the Anaheim High School band, an address of welcome was given by Mayor Charles H. Mann of Anaheim, who presented the first speaker, Mr. Phil A. Stanton, senior member of the California Highway Commission, a resident of that city and for many years a prominent citizen and developer of Orange County.

MR. STANTON CUTS RIBBON

Following a brief address by Mr. Stanton, other prominent visitors, including Justus F. Craemer, Assistant Director of Public Works; Highway Commissioners William T. Hart of San Diego County and Paul G. Jasper of Humboldt County, Julien D. Roussel, Secretary of California Highway Commission; C. C. Carleton, Chief of Division of Right of Way and Contracts, L. V. Campbell, Engineer of City and Cooperative Projects, and other prominent State, County and City officials were introduced.

Mr. Kelly then made a short address preceding the dedication ceremony.

In deference to Mr. Stanton's long years of service on behalf of better highways, Mr. Kelly then delegated to him the honor of formally dedicating this highway by cutting the ribbon, which had been extended across the road by Virginia Myer of Norwalk and Betty Ruth Boney of Anaheim.

STARTED IN 1924

The meeting then adjourned to the Anaheim Elks Club for luncheon and the completion of the program. There were approximately one hundred fifty persons in attendance at the luncheon held in conjunction with the Anaheim Lions Club.

Commissioner Stanton, in his remarks, recalled the history of the road which started with the formation of the Greater Manchester Avenue Improvement Association in 1924.

He said:

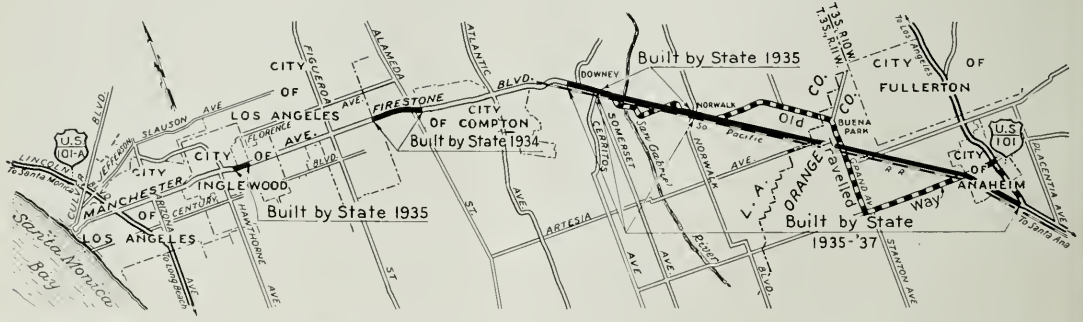
"Although only partially completed several months ago this road carried as many as five hundred vehicles per day. That number has now increased to where nine thousand cars per day pass over."

MAJOR STATE ARTERY

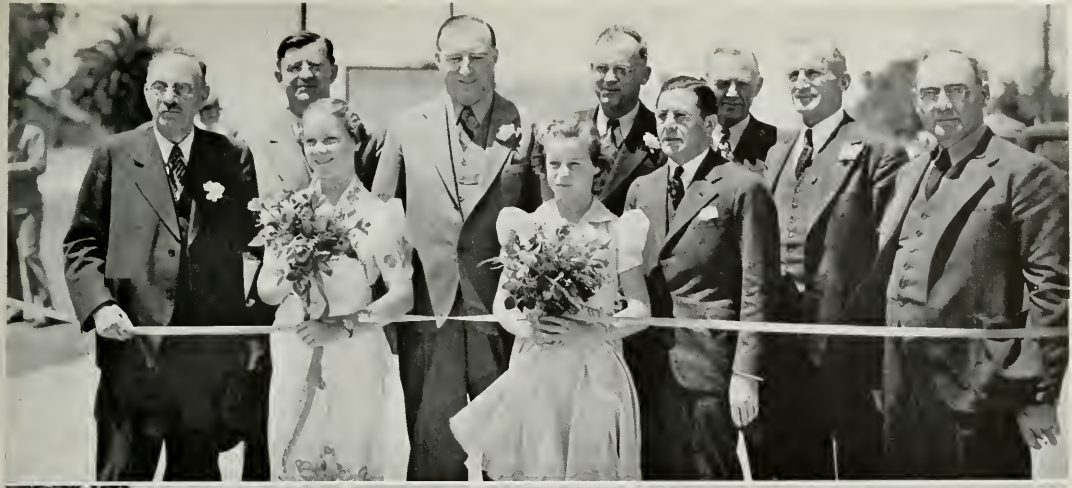
"Already a major State artery," Mr. Stanton said, "the highway represents one of the most progressive steps taken for this vicinity. It is my hope that before my present term of office shall expire that I will see a fourth lane constructed along the entire distance of thirty-three miles."

Mr. Kelly, in his remarks, paid tribute to Mr. Stanton's work in sponsoring the road. He spoke of the immense growth of traffic in the past

(Continued on page 28)



Improved sections of Manchester Boulevard and Firestone Boulevard, which is part of former. Dotted line shows old route.







Official guests at opening of Anaheim link of Manchester Boulevard. Upper, left to right: State Highway Commissioner P. A. Stanton, Assistant Director of Public Works Justus F. Craemer, Director of Public Works Earl Lee Kelly, Highway Commissioner Paul Jasper, President Victor Loly, Anaheim Chamber of Commerce; E. E. East, District Highway Engineer S. V. Cortelyou and Mayor C. H. Mann of Anaheim. Holding the ribbon are Betty Ruth Boney and Virginia Myer. Center: New link of Manchester Boulevard south of Anaheim. Lower: Stretch of highway between Norwalk and Downey increased to three-lane road.

Conejo Grade Dedicated With Colorful Show

(Continued from page 8)

lowed with prospectors, trappers, oxen and Mexican carreta, covered wagons, pony express riders, stage coach and four skilled Spanish equestriennes, buckboards, surrey and automobiles ranging from the earliest models now in running condition to the "1937 car of streamlined elegance." It might well have been called a pageant of progress in transportation and the Mission Trails Association and Mr. Raymond should feel proud of the inspiring result.

PROGRAM OF SPEECHES

Immediately after passage of the transportation cavalcade, a few well-worded speeches were delivered. Master of ceremonies Frank C. Balfour introduced the speakers. The district engineer made a brief talk explaining some of the obstacles which were overcome in carrying this huge project through to completion and introduced the members of his staff. Other speeches were made by Frank Miratti, Jr., of Santa Barbara, first president of the California Mission Trails Association, Ltd., and now one of its directors, and S. K. Mittry of Mittry Bros. Construction Company, general contractor on the project. General regret was expressed that it Mittry Bros. Construction Company, was impossible for our local highway Commissioner Mr. P. A. Stanton, to be present.

The California Highway Commission was represented by Commissioners H. R. Judah from Santa Cruz and Paul G. Jasper from Fortuna. Both commissioners spoke briefly. The principal address was given by Director of Public Works Kelly, who commented on the magnitude of the project, its relation to the unified system of highways for the entire State of California and other interesting facts regarding State highway work.

Following this speech, Mr. Kelly took his position in the driver's seat of the motor grader and pushed aside a large boulder from the pavement while a battery of news cameras made a record of the official opening to traffic of this new improvement.

The old Conejo Grade highway constructed by the California Highway Commisison in 1914–15 was 5.6 miles in length or 0.8 mile longer than the revised alignment just completed.

It might be stated in this connection that the road as originally constructed in 1914–15 was built to adequate standards of alignment and grade for that era of our highway development. Since that date, however, both highways and automotive transportation have developed rapidly and the highway standards of that date can no more be considered adequate in 1937 than could the 1914 automobile be considered suitable for present-day needs.

HIGHWAY WORK COST $550,000

The contract for the new improvement was awarded November 27, 1935, and work started December 11, 1935. An average of 100 men have been employed on this project since commencement of construction operation and a total direct employment of 272,000 man hours have been utilized. The cost of the highway work is about $550,000. The bridge over Conejo Creek at the foot of the grade, constructed by Robert D. Patterson, contractor, cost $20,000 making a total cost of the whole improvement of approximately $570,000.

The roadbed is graded to a width of 46 feet, on which a payment of concrete 20 feet in width was placed with wide oil mixed shoulders on each side. On the Conejo grade itself the pavement is separated in two 10-foot wide pavement lanes with a 10-foot wide strip of plant-mixed surfacing between to facilitate passing the slower moving vehicles.

A total of over 800,000 cubic yards of excavation, mostly hard rock, have been required to complete the project. The minimum sight distance on this highway is 800 feet which means a high degree of safety built in to the fundamental design of this important traffic artery.

"Now," said the teacher, "which of you can name five things that contain milk?"

"I can," shouted a freckle-faced youngster, "Butter, and cheese, and ice cream, and two cows."

47 Curves Taken Out of Redwood Highway Sector

(Continued from page 6)

grates are provided so that the full section of highway may be traveled.

JOB SPEEDED UP

There were two main reasons for the adoption of this section. The first was economy. Cuts were made 30 feet wide at grade instead of the usual 36 feet to 38 feet; this resulted in a saving of at least twenty-five per cent in excavation. The second factor considered was safety. Ditches contribute to many accidents, particularly in this section where average annual rainfall fluctuates between forty and sixty inches.

The contract for this project was awarded to Hemstreet and Bell in August, 1936. By utilizing a large number of heavy construction units and a force up to two hundred men, they were able to complete all the work on this job with the exception of half the base gravel and the surfacing for the south mile before the winter storms. The application of asphaltic seal coat and general cleaning up remains to be completed when weather permits.

BUILD NEW BRIDGE

The project north of Willits was carried on concurrently with a short project immediately south of town. This was designated as I-Men-1-E, Eleven Oaks to Willits. This job provides for the replacement of a narrow concrete bridge over Baechtel Creek.

The contract was awarded to A. Soda & Son, in October, 1936, at an estimated cost of $56,200.40. Due to the very dry fall the contractors were able to get the grading almost completed, more than half the pit run gravel base placed and the new bridge completed. The project should be entirely finished early this summer.

Upon the completion of these two projects in Mendocino County, a real step forward in safety and economy of operation will have been accomplished in behalf of both heavy and passenger traffic who use the Redwood Highway.

She: "Did you notice anything funny about John's nicce?"

He: "Yeah, they're kinda knobby."



INTERESTING AND VALUABLE

San Francisco, April 13, 1937.

Calif. Highways & Public Works,
Sacramento, California.

Gentlemen:

On the reading table of the Olympic Club yesterday I read from the March issue of your magazine.

If it is possible I would like to receive a copy of the March issue and also have my name placed on your mailing list. Your magazine certainly contains much interesting and valuable matter.

Yours very truly,

Wm. A. Sherman, President,
MERCHANTS ICE AND
COLD STORAGE COMPANY.

Praise for Magazine

University of California,
School of Jurisprudence,
Berkeley.

Editor, California Highways and
Public Works, Department
of Public Works.

Dear Mr. Howe:

This is to acknowledge the receipt of the Bridge Edition of the California Highways and Public Works Bulletin. I appreciate very much your sending this to me.

I have shown it to several friends here on the faculty and they are all full of praise for its fine composition and workmanship.

Very sincerely yours,

R. E. STONE.

IMPRESSIVE RESEARCH WORK

AMERICAN AUTOMOBILE
ASSOCIATION

Washington, D. C., April 30, 1937.

Editor, California Highways and
Public Works,
Sacramento, Calif.

Dear Sir:

I have just concluded reading the article on traffic accidents by T. H. Dennis in the April, 1937, issue of "California Highways and Public Works." May I say that this was extremely well done and constitutes what is to my mind an impressive piece of research work which should be made available to people interested in the proper development of our highways from the standpoint of safety.

I wonder if you would be kind enough to send me a dozen additional copies of the detailed tabulations referred to in the last paragraph of the article on page 11? I will greatly appreciate having this material and will be glad to remit, if there is a charge.

Yours very truly,

A. J. Montgomery, Director
Department of Public Relations.

100 Bush Street
San Francisco

May 10th, 1937

California Highways and
Public Works
Sacramento, California

Dear Mr. Howe:

My copies of California Highways and Public Works which I receive at my home address, 1134 Excelsior, Oakland, are as thumb-worn by my friends as the new "Life" magazine.

It would be difficult to estimate the value of your publication in advertising the fine highways and the work of the Division throughout the State.

Sincerely yours,
THE PACIFIC LUMBER COMPANY,
Max E. Cook,
Agricultural Engineer

THE TEXAS COMPANY

135 East 42nd Street, New York

Editor, California Highways and Public Works.

Dear Sir:

Your publication is one of the few that I look forward to each month and read with a great deal of interest and pleasure. It contains information that is of vital importance to those of us who are identified with the direction of motorists.

I have been especially interested in the articles on "California's Uniform Road Sign System Provides Drivers An Infallible Guide to Safety," as we have been emphasizing safety and carefulness, beginning in 1930, in all our publicity.

You may be interested in knowing that in the last two years we have emphasized the meaning of the diamond and the octagon shape sign on all Texaco Road Maps. And that the meaning of the five standard shapes has been emphasized in the routing suggestions that we sent to over one-half million motorists last season.

Cordially,

S. C. HAWLEY, Director.

A large redwood tree that threatened damage to the Eel River Lodge near Benbow was removed last month by men of the maintenance crew of the Division of Highways under C. A. Miller, Maintenance Superintendent, District 1, and their service in this respect prompted the following letter of appreciation. The tree was approximately five feet in diameter and was leaning directly over the main buildings of the Eel River Lodge at about 20 degrees from vertical.

EEL RIVER LODGE

On the Redwood Highway,
Benbow, California

April 6, 1937

Mr. J. W. Vickrey,
Eureka, California.

Dear Sir:

The hazard of the leaning tree opposite the Lodge to which I referred in my letter of March 2 has been removed and while the removal of such hazards may be an everyday matter in your department I can not refrain from expressing my personal appreciation of the skilful manner in which Mr. Miller laid his plans, put them into effect with the utmost care and finally with the able assistance of Mr. Sam McCush and a picked crew of men laid this extremely dangerous tree up the hill exactly on the spot pointed out to me prior to the completion of the operation.

My lay wonder at the accuracy of the operation and the care taken to safeguard my property may appear to be foolish in your eyes but I am grateful to you and Mr. Miller for the removal of the tree and the considerate care taken in performing the operation and I wish to go on record to this effect.

Yours very truly,

(Signed) C. H. PELL,
Eel River Lodge.

Maryland, New Jersey Penalized by U.S. for Gas Tax Diversion

TWO States, Maryland and New Jersey, already have been penalized under authority of the Hayden-Cartwright Act of 1934 for diversion of gas tax funds.

Maryland has been deprived by the U. S. Bureau of Public Roads of one-third of its 1937 share of Federal road aid funds because it diverted approximately $4,000,000 of gasoline and motor vehicle tax revenues to purposes other than highway construction and maintenance and now New Jersey has suffered withdrawal of $558,906 of Federal aid for the same reason.

Thomas H. McDonald, chief of the Bureau of Public Roads, notified the Maryland State Road Commission that this year's allocation of Federal monies has been reduced $341,666.66 and has informed New Jersey of the penalty imposed upon it. Governor Hoffman of New Jersey recently vetoed a bill designed to provide for additional diversion of the State's highway funds to emergency relief financing.

In announcing the penalties, McDonald said that his bureau is now investigating the expenditures of gas tax revenues and motor vehicle registration fees in every State with the idea of applying penalties wherever these funds have not been spent on highways.*

When Governor Harry W. Nice of Maryland was informed of the State's loss, he immediately advocated the cancellation of all diversions and urged that all money diverted in the past be restored to the highways.

In view of the widespread investigation being conducted by the Bureau of Public Roads it is believed penalties will run into millions of dollars, since a number of States have been diverting gas tax and motor vehicle license fees for other than highway purposes. The largest diversion has been in New York, it is said.

Attention was first called to the poor condition of rural roads in Maryland by the dynamiting of a farmer's automobile to clear the way for other stalled cars. Then students in a rural school struck because impassable roads made it impossible for them to attend school regularly, following which the government discontinued mail service on Rural Route No. 2 out of Rockville, Montgomery county.

OTHER STATES TO SUFFER

Maryland imposes a 4 cent per gallon gasoline tax, plus motor vehicle registration fees, ostensibly to finance roads. The Legislature, however, has ordered part of these revenues used for other purposes and during the present session has proposed to divert additional money.

Commenting on the penalty inflicted upon Maryland, Congressman Wilburn Cartwright, one of the authors of the Hayden-Cartwright Act, and chairman of the House Committee on Roads, said:

"Section 12 of the Hayden-Cartwright Act of 1934, provides that States diverting highway funds shall be penalized not to exceed one-third of the Federal-aid allotments for highways. It appears certain that the Secretary of Agriculture will announce and take action immediately on penalties through the loss of Federal aid to several States for diversions heretofore made.

DIVERSION INDEFENSIBLE

"There is strong sentiment in the roads committee and in Congress for increasing the penalty at this session to two-thirds of the apportionments or denying Federal aid altogether to States that persist in the indefensible practice of diverting their own gasoline and other motor-vehicle tax revenues to nonhighway purposes. In fact, some consideration is being given to discontinuing the policy of Federal aid for highways, if States, by their diversions, defeat the purpose of Congress to hasten the completion of the State highway system.

"There is no longer one shred of an excuse for this type of dishonest misappropriation of the public's money. I repeat again the unquestionable truth that the State that continues to divert its gasoline-tax and motor-vehicle revenues to nonhighway purposes will suffer a stiff penalty in Federal aid."

A Warning to All Other States

The United States Bureau of Public Roads has just cut the Federal allowance of Maryland one-third, or $341,666.66, because that State has diverted a large part of the proceeds of her gasoline tax into nonhighway purposes.

The Hayden-Cartwright Road Act of 1934 provides that States may be penalized up to one-third of their Federal apportionment during any year in which gasoline tax money is diverted. Maryland is the first State to suffer the penalty; but she is not likely to be the last.

Here is a plain warning to the legislatures of nearly all the States. The Hayden-Cartwright Act was passed to protect the motorist against the sort of class taxation which results when legislatures use gasoline tax money for purposes other than those for which the money really was paid.

Every one who owns an automobile should be happy to learn that the Hayden-Cartwright Act is in effect; that it has teeth; and that the Bureau of Public Roads intends to make use of it. The American motorist has been mulcted long enough by legislators who found it easier to soak him than to devote any real thought to the problem of fair taxation.—*Sacramento Bee.*

* Such a loss of Federal funds probably never will be suffered by California because Governor Frank F. Merriam and the Legislature of this State as well as the electorate have gone on record several times as opposed to any diversion of gas tax funds.

Bay Bridge Tolls Decrease During Month of April

ALTHOUGH the daily average number of vehicles crossing the San Francisco-Oakland Bay Bridge and the total number of vehicles passing over the structure during April showed a slight increase over March, there was a decrease in the amount of tolls collected, according to the monthly traffic report submitted to Director of Public Works Earl Lee Kelly by Chief Engineer C. H. Purcell.

"The daily average number of vehicles crossing the bridge for April was 25,559; for March, 24,720," Mr. Kelly said. "The total number of vehicles for April was 766,790; for March, 766,315. Total collections for April were $399,731.60 as compared with $401,975.30 for March."

"This tends to show," Mr. Kelly said, "that there was unusually heavy traffic for March beyond the seasonal expectancy.

"Evidences of summer vacationists are shown in the increased number of auto trailers, which last month amounted to 1045—an increase of 336 over the preceding month or one-quarter of the total since the bridge opened."

Last month's figures brought the total number of vehicles crossing the bridge since its opening to 4,111,000, according to Mr. Kelly.

Freight pounds for April were increased by 2,000,000 over the March total.

Out of 4,111,000 vehicles which have crossed the bridge since it opened only 37 accidents involving personal injury have occurred, with a total of five accidents involving fatalities.

Based on the total car miles of 34,943,500 from November 12 to May 1, there has been one accident involving personal injury for every 944,419 car miles. There has been one fatal accident for every 6,988,700 car miles. In other words, a vehicle would have to drive 6,988,700 miles before it had a fatal accident. The number of car miles involving accidents, which include property damage as well as personal injury, is 537,591 per vehicle. There have been 65 persons injured in bridge and approach traffic accidents.

Highway Bids and Awards of Contracts for the Month of April

LOS ANGELES COUNTY—Between Center Street and Firestone Blvd., 3.5 miles to be graded and paved with Portland cement concrete and plant-mix surfacing applied. District VII, Route 168, Section A. B. G. Carroll and C. B. Grove, San Diego, $170,687; C. F. Robbins and Atlas Construction Co., Pasadena, $184,403; C. O. Sparks and Mundo Engineering Co., Los Angeles, $195,293; Sully Miller Contracting Co., Long Beach, $191,167; Griffith Co., Los Angeles, $172,531; Oswald Bros., Los Angeles, $163,582; United Concrete Pipe Corporation, Los Angeles, $193,516; J. E. Haddock, Ltd., Pasadena, $173,608. Contract awarded to Matich Bros., Elsinore, $161,365.50.

LOS ANGELES COUNTY—Grade separation structure at Firestone Blvd. and Graham Ave., sidewalks and stairways to be constructed. District VII, Route 174, Section B. S. Tedesco, Huntington Park, $15,292. Contract awarded to D. A. Loomis, Glendale, $14,668.

SAN DIEGO COUNTY—A crossing over tracks of A. T. and S. F. Ry. near Solano Beach, consisting of reinforced concrete bridge and grading 0.10 mi. of roadway and applying plant-mix surfacing. District XI, Feeder Road. E. S.-N. S. Johnson, Pasadena, $19,210; A. S. Vinnell Co., Los Angeles, $17,541; C. O. Sparks and Mundo Engineering Co., Los Angeles, $17,916; Oscar Oberg, Los Angeles, $18,795; R. R. Bishop, Long Beach, $19,477; J. R. Lippincott, Los Angeles, $22,182; B. G. Carroll, San Diego, $16,108; V. R. Dennis Construction Co., San Diego, $17,869; D. A. Loomis, Glendale, $16,959; F. O. Bohnett, San Jose, $16,799. Contract awarded to Griffith Co., Los Angeles, $15,315.

SAN DIEGO COUNTY—A reinforced concrete girder crossing over the tracks of the A. T. & S. Fe Ry. near San Onofre. District XI, Route 2, Section D. F. O. Bohnett, San Jose, $59,600; Andy Sordal, Long Beach, $52,010; Sander Pearson, Santa Monica, $51,715; Oscar Oberg, Los Angeles, $57,072; Parish Bros., Los Angeles, $48,823; R. R. Bishop, Long Beach, $51,907; Carlo Bongiovanni, Los Angeles, $57,870; Gates and Huntley, Los Angeles, $52,839; T. A. Allen Construction Company, Los Angeles, $58,548; C. O. Sparks and Mundo Engineering Co., Los Angeles, $49,051; Atlas Construction Co. and C. F. Robbins, Pasadena, $54,479; Griffith Co., Los Angeles, $53,584; Daley Corp., San Diego, $55,036; D. W. Thurston, Los Angeles, $64,701; J. E. Haddock, Ltd., Pasadena, $56,196. Contract awarded to B. G. Carroll, San Diego, $47,763.

SAN DIEGO COUNTY—Furnish and haul earth for district shop and maintenance yard site. District XI, Route 2, Section S.D. V. R. Dennis Construction Co., San Diego, $7,295; A. C. Bussey, Riverside, $13,570; Triangle Rock and Gravel Co. and Chas. Holmes, San Bernardino, $10,202; E. P. Watson, San Diego, $7,012; R. E. Hazard and Sons, San Diego, $8,745; C. B. Graves, San Diego, $6,651. Contract awarded to John Hansen, San Diego, $5,396.

SAN MATEO COUNTY—Roadside trees to be trimmed between Millbrae and San Mateo. District IV, Route 2, Section A. Burl., Hil., S.M. Union Paving Co., San Francisco, $13,030; Davey Tree Surgery Co., San Francisco, $5,957; A. G. Raisch, San Francisco, $14,570; Sohner's Tree Service, San Anselmo, $10,350. Contract awarded to Rexroth and Rexroth, Bakersfield, $2,691.50.

SANTA BARBARA COUNTY—Between Miramar Ave. and Olive Mill Road, 0.6 mile to be graded and surfaced with asphalt concrete or natural asphalt concrete and a reinforced concrete bridge to be widened. District V, Route 2, Section J. Heafey-Moore Co., Oakland, $88,711; Daley Corporation, San Diego, $88,181. Contract awarded to J. E. Haddock, Ltd., Pasadena, $81,292.10.

SIERRA COUNTY—Between Goodyears Bar and Downieville, 3.9 miles to be graded, surfaced with selected material and penetration oil treatment applied. District III, Route 25, Section A. A. Teichert and Son, Inc., Sacramento, $132,746; Larsen Bros. & Harms Bros., Sacramento, $141,442; Fredrickson and Watson Const. Co., and Fredrickson Bros., Oakland, $148,939; Louis Biasotti and Son and John Rocca, Stockton, $154,152; Young and Son Co., Ltd., Berkeley, $155,067; Earl W. Heple, San Jose, $160,121; John Carlin, San Francisco, $182,176. Contract awarded to Hemstreet and Bell, Marysville, $131,360.

44 PER CENT OF HIGHWAY FATALITIES, PEDESTRIANS

Pedestrian fatalities in 1935 were 44 per cent of the annual highway killing. Approximately 16,150 persons walked to their deaths. Another 325,000 were injured, according to a report of the Reasearch Board.

Urban places, comprising cities having a population of over 10,000, account for 47 per cent of all pedestrian fatalities; the remaining 53 per cent occur in rural areas, including small towns. The pedestrian toll in cities is 64 per cent of all city traffic deaths, while in the case of rural deaths the pedestrian accounts for only 35 per cent of the total.

The trend in urban and rural casualties from 1930 to 1935 reveals that in urban places total highway deaths decreased 10 per cent, while pedestrian deaths fell 11 per cent. In rural areas, however, while total traffic fatalities rose 28 per cent, those involving the pedestrian increased 40 per cent.

Destination, Information And Location Sign Types Described

By F. M. CARTER, Assistant Maintenance Engineer

UNDER the classification of "Guide Group," signs used by the California Division of Highways for the safeguarding of motor vehicle traffic are designated as Route Markers, Destination, Location and Information. Route Markers were discussed in these columns last month and in this, the fifth of a series on highway signs, the other three signs will be taken up.

Destination Signs are more commonly called directional signs, as they are used to direct traffic to destination points.

Such signs are almost always positioned at intersections.

With the advent of the automobile the destination sign became an important factor in highway driving.

ONLY FOUR DESTINATION SIGNS

Each increase in speed has necessitated reduction of names until now the common practice is to hold all destination signs to four names. On the more important and heavily travelled highways the names on the destination signs are reduced to three on a plain sign, and to two names when reflectorized.

This reduction in the number of names permits the use of larger wording which is much more easily read.

On routes leading through a hilly or mountainous section where the same route is used for several towns and communities, it is desirable to indicate several points of importance along the route.

This is also true in the thinly populated areas where towns are very far apart.

CAREFUL NAME SELECTION

At the intersections in such areas the stranger motorist should be given enough information to reach his desired destination.

This necessity for the reduction of names on destination signs makes the selection of the right name an extremely delicate problem. Naturally every community whose name was on the multiple name sign resents being eliminated. This is, of course, a natural stand to take and also one that is highly commendable from a local interest point of view, but when such public spirited citizens stop and consider that in the interests of safety the highway signs must be more easily and quickly read local interest is suppressed in the desire to do the most good.

Conforming to our social common law the names of the well-known and important cities are used.

COUNTY SEATS IMPORTANT

The common practice is to use the county seat as the most important city in the county or the important city at the terminus of the route.

The use of the names of such well known cities enables a traveller to obtain the information he desires with the least confusion.

For night driving reflectorized name signs are placed approximately one hundred feet in advance of the intersection. Where physical features do not permit such advance positioning, the signs are placed to give the indication as soon as possible before the motorist reaches the point of decision of routes.

REFLECTORIZED SIGNS

These reflectorized name signs have not more than two names, one in each direction.

In addition to the reflectorized name signs the reflectorized numbered shield is used in advance of intersections to indicate to the night driver that such a numbered route is beginning or crossing the route he is traveling.

In some cases where such signing is feasible the reflectorized name of the terminus of the numbered route is used in conjunction with the reflectorized numbered shield and arrow.

The trend in all such indicational signing is to educate the motorist to the use of numbers—all travel maps now show the numbered routes and if people planning a trip will determine those numbered routes which will take them to their destination, the ease of driving will be increased and the confusion at intersections will be reduced.

LOCATION SIGNS

When driving even on a numbered route the motorist wishes to know the names of the communities through which he is passing, and also to reassure himself that he is on the right route and how much farther he has to travel. This information is given to the motorist by placing a sign at the boundaries showing the name of such communities. These names are black, on a white background, in letters five inches in height, and are easily read. Such signs are placed at limits of all communities having a post office or a railroad station with a regular attendant.

These city and town name signs are placed at the limits facing travel entering the community.

REASSURANCE SIGNS

Directly across the highway facing traffic leaving the community is a three name sign. The first name is the next city or town. The second name is the county seat. If the county seat is not on the highway being travelled the second name will be the principal city, of the county, which is on the highway.

The last name is the terminus of the route.

The three name signs with mileages are commonly called reassurance signs. The motorist learns the name of the next city or town with the distance and also the distance to a large city and the terminus. This enables him to plan his trip as he proceeds.

Other information signs include names of rivers, at bridge heads, names of counties at county lines,

(Continued on page 28)

"Directional" Group of California Road Signs



Informational sign to mark or direct traffic to registered historical landmarks.



Placed about 400 feet in advance of intersection, directing traffic to turn from traveled way into another road to reach city directed to.



Reassurance directional sign. Placed at the limits of cities and towns to guide travel leaving the community.



Informational sign to identify boundaries of California State Parks. Placed at actual park boundary lines.



Standard single name reflectorized sign. Placed a short distance in advance of intersections or cross roads to guide traffic without delay.



Directional sign placed at intersections and cross roads to guide traffic to three different cities or towns.



Information sign to identify a river and bridge. Placed at each end of bridge.



Placed at intersections to mark or designate important county roads. Reflectorized for night driving.



One-name directional sign placed at intersections and cross roads to direct traffic to a particular town or city.



This sign is placed on highways to designate the location of a county line.



This directional sign is the same as above except for size and is used to direct traffic to four different cities or towns. Placed at intersections and cross roads.



Large reflectorized directional sign, having from six to twelve inch letters. Placed at important intersections to avoid confusion by properly directing travel in advance. Only one name and corresponding arrow is used for each direction.



Placed at highway summits of mountain passes to identify location and inform traffic of correct elevation.



Another directional sign similar to above except it contains names of two cities or towns.



Placed in advance of public drinking fountains. Traffic is directed to park off highway at these points.



Same as above, except the vertical arrow is used to convey the message of proceeding straight ahead for Oakland, while a left turn is necessary for San Jose.



This sign is placed to mark the limits of cities and unincorporated towns. When placed for towns, words "city limits" not used.



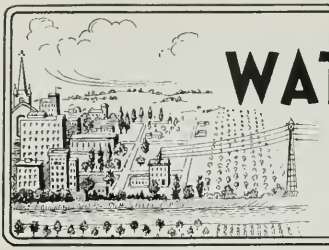
Placed usually on mountain highways to inform motorists of elevations. Used in multiples of 1000 only.



Plain type directional sign, showing the name of the next principal city or town in each choice of direction.



Used at intersections to designate county roads in same manner as street name signs are used in cities.



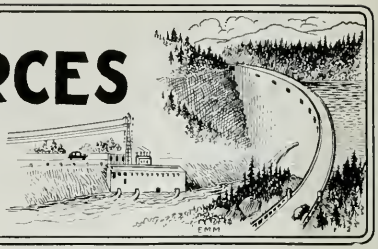
DIVISION OF WATER RESOURCES

OFFICIAL REPORT

FOR THE MONTH OF

April, 1937

EDWARD HYATT, State Engineer



During the last week of March and the first week of April the main annual snow survey was made throughout the Sierra Nevada mountains from Mount Shasta in the north to Kernville on the south. This two-weeks measuring period was characterized by a series of storms intermingled with occasional days of fine weather.

All of the snow surveys have now been received and the results analyzed, and forecasts of runoff for the coming year have been made. All of these forecasts together with supporting data have been assembled and published in the regular snow survey bulletin dated April 1st and mailed to the public on April 12th.

An analysis of the snow surveys shows that while there is a slight shortage in the Sacramento-Pit region in the north, elsewhere the spring runoff will be above normal, and from the San Joaquin River south to the Kern will be the greatest since the snow surveys were begun in 1930.

IRRIGATION DISTRICTS

On March 30th, the Fallbrook Irrigation District in San Diego County voted by large majority, a bond issue in the amount of $500,000 for construction of irrigation works and development of a water supply from San Luis Rey River.

Two districts completed refinancing programs during the month. Tracy Clover Irrigation District received a loan of $20,000 from the Reconstruction Finance Corporation with which to retire an existing debt of $65,670. Citrus Heights Irrigation District refunded outstanding bonds in the amount of $142,000 with a loan of $86,000, augmented by district funds.

Of special interest to districts in the process of refinancing was the approval by Governor Merriam on March 30th, of an emergency measure known as the "Irrigation District Refinancing Act," which provides ways and means through State law for liquidating and readjusting indebtedness of irrigation districts in default.

Districts Securities Commission

Two meetings of the Commission were held in San Francisco during the month for consideration of petitions filed by irrigation districts.

At the meeting of April 9th, Richvale Irrigation District was granted permission to issue bonds in the amount of $90,000 to purchase additional water rights and canals for lands that were recently annexed to the district.

At the meeting of April 19th, the Commission reviewed the plans for refinancing the indebtedness of Palo Verde Irrigation District, and approved the same, in order that the district might file a petition for readjustment in the Superior Court under the recently enacted Irrigation District Refinancing Act.

FLOOD CONTROL AND RECLAMATION

Relief Labor Work

An average of 118 men on WPA Project No. 5416 were engaged during the month in clearing the overflow channel of the Feather River north of Marysville and near Nicolaus. SRA Transient Camp No. 7 in the Sutter Basin furnished an average of 48 men for work on the east levee of Sutter By-pass, at Pumping Plant No. 1 and No. 2 and at the Sutter maintenance headquarters. It was impossible to work in the Tisdale By-pass during this period on account of overflow.

WPA Project No. 6654, Yolo County, commenced operations on April 2d, since which time an average of 31 men have been employed on clearing brush and timber from levees of the Sacramento By-pass and poisoning squirrels.

Flood Measurements

All danger of flood for this season seems to be passed, and operation will be discontinued on the river stage stations at various times from May 15th to 30th. The four radio sending stations were discontinued on April 25th, the equipment being removed for summer use by the irrigation water masters of the Division.

SUPERVISION OF DAMS

Application was filed on March 25, 1937, for the alteration of the Lafayette Dam of the East Bay Municipal Utility District. This application covered certain changes in the discharge lines and spillway provisions.

Construction on the fill at San Gabriel Dam Number One of the Los Angeles County Flood Control District is progressing in a satisfactory manner. The spillway excavation is well under way and the plans for the lining of the same have been completed. At the Cajalco Dam of the Metropolitan Water District the work of placing fill on the dike is practically completed and the pouring of the concrete face on the dam and dike is progressing rapidly. The cutoff in the main dam is practically completed.

Work, resumed last month after the temporary shutdown due to weather conditions at O'Shaughnessy Dam of the City and County of San Francisco, is progressing rapidly. The concrete downstream from the old structure is practically completed to the old crest of the dam.

WATER RIGHTS

Supervision of Appropriation of Water

Twenty-one applications to appropriate water were received during March, 19 were denied and 24 were approved. Eleven permits were revoked and the rights under 6 permits were confirmed by the issuance of license.

Among the applications approved were six by the Santa Clara Valley Water Conservation district of San Jose involving appropriations from Almaden, Guadalupe, Los Gatos, Calero and Stevens Creeks at an estimated cost of $1,961,000.

SACRAMENTO-SAN JOAQUIN WATER SUPERVISION

During the past month, this office has been preparing the data to publish a report showing the amount of water diverted from and returned to streams in the Sacramento and San Joaquin territory. This report will show the amount of land irrigated, flow in the stream channel, and the rate of advance and retreat of salinity in the delta.

Field work has commenced and at present consists of observing all points of diversion to insure that records of operations will be kept during the coming season. The abundance of rainfall has made early irrigation unnecessary this year.

CENTRAL VALLEY PROJECT

The United States Bureau of Reclamation continued work during the month on the preparation of plans necessary for starting construction on the initial units of the project. Preliminary investigations and exploration work have been continued at Kennett and Friant dam sites as have the surveys along the Contra Costa conduit and Friant-Kern canal.

New Charter Way Underpass Opened in Stockton City

(Continued from page 10)

This new underpass will doubtless take most of this traffic, especially after an underpass is completed under the Santa Fe tracks on Wilson Way, on U. S. 99. Bids for this project will be opened this month.

The signing by President Roosevelt of the Emergency Relief Appropriation Act of 1933 made available Federal funds for the construction of highway-railroad grade separation structures. Charter Way underpass is one of the structures now completed by the State under this act.

RAILROAD CROSSING PROBLEM

At Charter Way, U. S. 50, crossed at grade a total of eight separate railroad tracks, one of the Western Pacific and seven of the Southern Pacific, all within a distance of five hundred feet.

Design studies were made to determine the most satisfactory structure for the problems involved, which included the separation of the highway and eight railroad tracks, and the maintenance of accessibility to adjoining improved property. To this end an undergrade crossing which would carry highway traffic under the railroad tracks was selected.

The crossing consists of a depressed portion 1072 feet 6 inches long, providing two 22-foot roadways separated by a 3-foot safety curb and two 4-foot pedestrian sidewalks, all flanked with retaining walls running the full length of the depressed portion.

RETAINING WALLS USED

Reinforced concrete construction was used throughout with the exception of the spans carrying the railroad tracks over the highway which were made of steel.

DIVIDED ROADWAY

Division of the roadway area into 2 two-lane roadways by means of the safety curb is in accordance with modern safety practice, providing as it does two traffic lanes for traffic traveling in the same direction. The safety curb also became of economic value for it permitted the use of intermediate piers to support the vehicular bridge and track span superstructures. Had it been necessary to span the entire roadway from retaining wall to retaining wall, much heavier bridge superstructures would have been required with consequnt increased cost.

As is usual in the case of undergrade crossing structures, with depressed portions below natural ground line, drainage of water entering the roadway had to be provided for. To this end two electrically operated pumping units, to operate alternately, were provided to pump from a sump located below the point of lowest grade line. Each pumping unit is capable of discharging not less than 750 gallons per minute and is so controlled that should water enter the depressed portion in excess of the pumping capacity of the pump in operation, the idle pump will come into operation. With this pumping equipment, it is believed the run-off from the heaviest rain will be handled without difficulty.

SAFETY FOR NIGHT TRAFFIC

To provide additional safety for night traffic, adequate lighting equipment to illuminate the roadway for the entire length of the depressed portion has been provided. For illuminating the roadway areas outside the limits of the vehicular bridge and track spans, electroliers supported on the retaining walls flanking the roadway are provided, and for the areas beneath the vehicular bridge and track span superstructures lighting units mounted in recesses cast in abutments and piers have been provided.

COST IS $310,000

The total construction cost for the underpass is approximately $310,000 including the cost of engineering. This project was financed from the Federal Works Program Grade Separation funds.

The subway was constructed by the State Division of Highways under contract awarded to Biasotti, Willard, & Biasotti & Rocca & Company.

All necessary right of way for the project was furnished by the city of Stockton, financed from the city's ¼¢ gas tax and other city funds.

States Making Surveys of All Highway Trends

(Continued from page 12)

Studies of commodities carried by trucks, and of the origins and destinations and trip-distances of trucks will throw light on the competition between highway carriers and railroads and other transportation facilities.

The financial studies are an indispensable part of the surveys. By analyzing both the revenues and the purposes of expenditures of the State and all its parts, we hope to estimate the future ability of the State to sustain a maximum highway investment.

That investment will not be limited merely by the number of miles the State can build and pay for, but the number which it can continue to pay for indefinitely after they are built.

Within that limit we hope to choose the most important coordinated sections of roads and streets which should comprise the ultimate improved system.

SURVEYS MUST CONTINUE

The road use and motor vehicle allocation studies will show us how to distribute the costs of the highways in proportion to their use. Another study will determine the economic life expectancy of road surfaces.

The investigation of general economic and social trends is now in the formative stage.

The work is not finished. Each State should consider the planning survey as a continuing function. Suspend it now, and the value of the work now done will soon be lost. The 1½ per cent provision has been retained in the Federal law for the fiscal years 1938 and 1939.* It should remain permanently, and possibly be enlarged; and no State should forego the opportunity it affords for intelligent highway planning.

* The 1½ per cent provision referred to by Mr. Fairbank requires that 1½ per cent of funds allocated by the national government to states under the Works Progress Program, the Works Grade Separation Program and Federal Aid to Highways shall be expended for highway planning surveys. Editor.

Manchester Boulevard Opening Climax of 13 Years Work

(Continued from page 18)

few years, saying that California will have three million dollars tourist trade this year, one of her "biggest crops."

Closing the program at the Elks Club, Mr. Kelly declared the State's highway system is eight to ten years behind the needs. "By the end of 1937," he said, "California will have more pleasure cars registered than has any other State."

Manchester Avenue already has required the addition of a third lane, and Mr. Kelly forecast the day when a fourth will be needed. "In time, Manchester will become one of the great highways of the State," he declared.

The plan to project this Manchester Avenue route from the Roosevelt Highway (U. S. No. 101-Alt.), near Playa del Rey, to connect with Coast Highway Route No. 2 (U. S. No. 101), near Santa Ana, became a unified program of the State in 1933, when this proposed route became a part of the State Highway System as Route 174.

At that time portions of the road had been laid as city streets, but with no connecting links. Then the only portion of this road improved to full width pavement was 5.9 miles within the city of Los Angeles. Since January 9, 1934, when construction was started by the State on the first contract, work has progressed steadily. With the cooperation of the cities and counties, rights of way have been secured, widening and new construction completed on 27.1 miles of highway, the completed roadway pavement surface varying in widths from thirty feet to seventy-six feet.

This entire program, costing some $2,700,000, has been financed out of the gasoline tax, with contributions being made by the cities and counties out of their share of the gas tax revenues.

Manchester Boulevard had its beginning in Graham in 1924, when a group of far-seeing business men met and formed the Manchester Avenue Improvement Association. While, at that time, Manchester Avenue was merely a line projected on a map, soon meetings began to be held at regular intervals along the proposed route.

MANY GROUPS GAVE AID

Since the inception of the plan, the following associations became affiliated with the Greater Manchester Improvement Association, and have worked towards promotion of the road: Los Angeles County Regional Planning Commission, City Planning Commission of Los Angeles, South Gate, Anaheim and Santa Ana; Chambers of Commerce of Inglewood, Graham, South Gate, Downey, Norwalk, Buena Park, Fullerton, Anaheim, and Santa Ana, the Inglewood Manchester Improvement Association; Southwest Chamber of Commerce; Vermont-Manchester Business Association; Harbor District Chamber of Commerce; Eastside Organization of Los Angeles County, and City Planners Association of Los Angeles County.

The first problem was construction of the road from Central to Alameda streets. The county of Los Angeles joined the State to obtain the right of way. From this strip, extensions east and west have been continuous, with hardly a day passing that some part of the road was not under construction.

FUTURE WIDENING PREDICTED

The last allotment of funds by the Highway Commission built the remaining 1.3 mile gap through the city of Anaheim, in connection with which it is of interest to note that in securing the right of way, the property of an old abandoned line of the Southern Pacific Railway was acquired between Anaheim and Miraflores Junction with Route 2. This same allotment also provided for the construction of a third strip of pavement from Anaheim to Norwalk, making the paved portion of roadway not less than thirty feet in width at any point. The right of way is one hundred feet.

It is anticipated that further widening will be carried on from time to time to properly and safely handle the constantly increasing traffic.

The dub golfer on the first tee swung three times at the ball and missed. Not discouraged, he looked up at the crowd, on the club porch and grinned. "Tough course," he said.

Direction Signs Are Important in Guide Group

(Continued from page 24)

names of passes with the elevation and location, approach signs at drinking fountains, etc.

California has one distinctive sign. It is used for historical landmarks, and is made up with white letters on a brown field. Such signs are placed on the main highway at the point of departure of the highway leading to the landmark. One such sign is provided for each direction of highway traffic and motorists are routed to those landmarks over the quickest and best route.

The historical landmarks are, as their name signifies, verified landmarks of California's early history. The points are marked by a plaque or nameplate, after being checked and approved for their authenticity by the State Chamber of Commerce and their registration by the Department of Natural Resources. Descriptions of these historical landmarks are available and the brown and white directional signs inform the motorist where the landmarks are located.

The description of signs in this article has to do with signs as they will be when brought up to date. There are many old type signs now in place, but as fast as it is economically and physically possible, these are being removed or repositioned to conform to signing as described.

SIGNS REPOSITIONED

The city and town name signs and the reassurance signs are being positioned on the main routes now, and all should be in place for the summer travel.

Much study and experimenting has been done to develop the signing of today. It is necessary to know the past history in order to plan the future. California wishes to make travelling easy—much money is spent each year informing the world as to the innumerable advantages in California.

The stranger from other States begins to form his opinion the moment he crosses the line into California. Our signing must be uniform, authentic, easy to read and follow. It is as important as the alignment, grade and surface of our highways.

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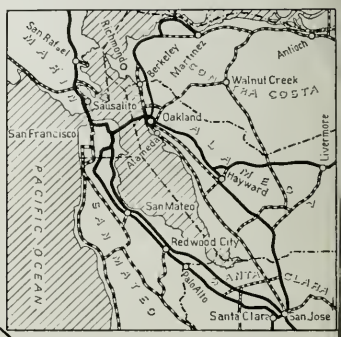
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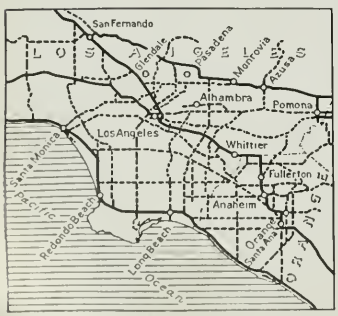
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SHOWING
STATE HIGHWAY SYSTEM

LEGEND
Primary Roads
Secondary Roads



SAN FRANCISCO AND VICINITY



LOS ANGELES AND VICINITY

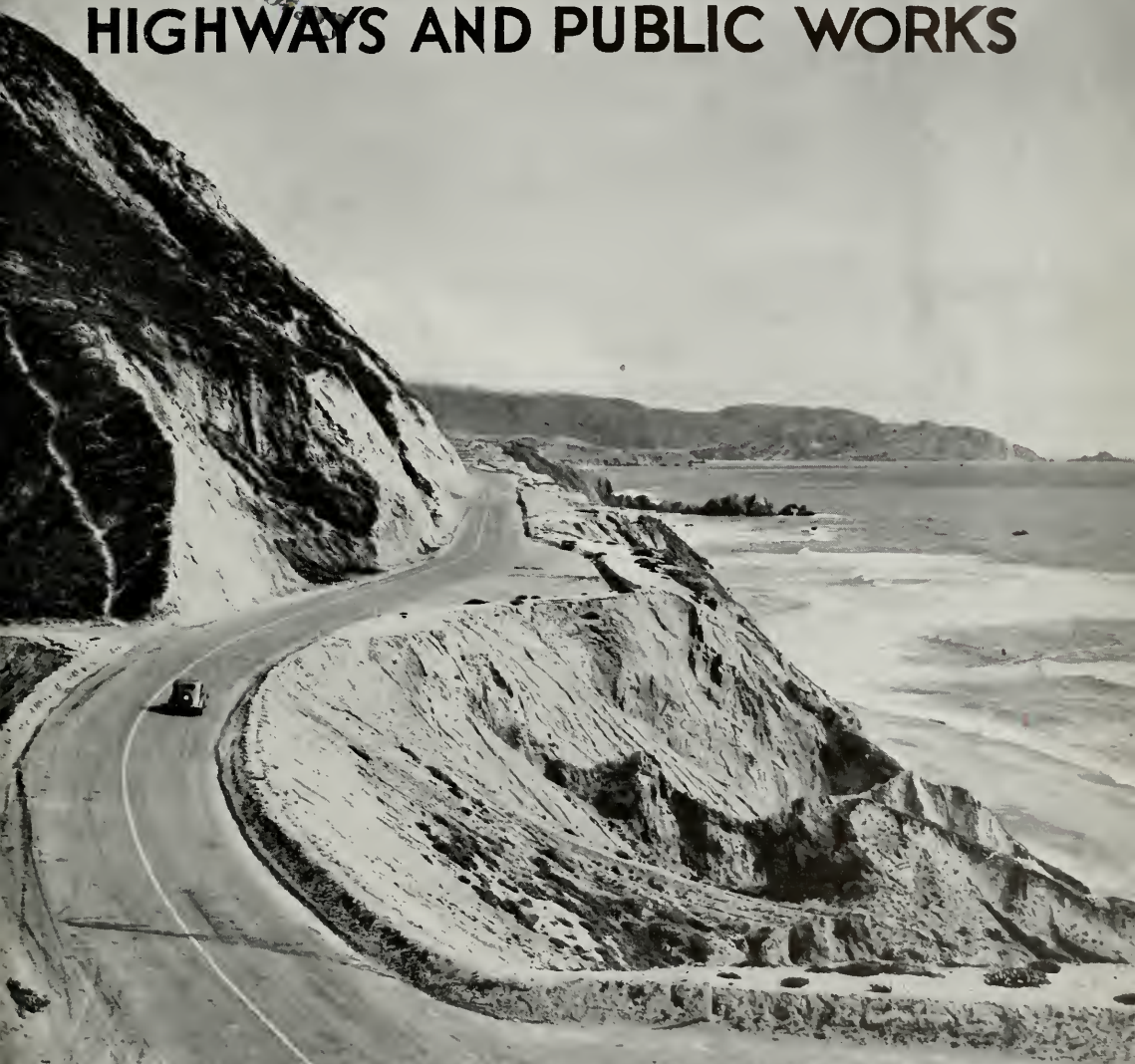
See Detail Map

See Detail Map

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CALIFORNIA
HIGHWAYS AND PUBLIC WORKS



Section of Picturesque Ocean Shore State Highway
Being Built in San Mateo County

Official Journal of the Department of Public Works

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CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways of the Department of Public Works, State of California

EARL LEE KELLY, Director | C. H. PURCELL, State Highway Engineer | JOHN W. HOWE, Editor

Published for information of the members of the department and the citizens of California

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New Highway Over Pedro Mountain Will Eliminate Dangerous Existing Grade

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By E. G. POSS, District Construction Engineer

A STATE highway, located within 15 miles of the city of San Francisco, is now under construction on the coast of San Mateo County which will take the place of one of the most dreaded travel routes of the Peninsula. This highway, between Rockaway Beach and Farallone City, will be a portion of the Ocean Shore Highway, Route 56, between San Francisco and Santa Cruz; and it is being built as a cooperative project, in which are joined the Federal government, the State, and Joint Highway District No. 9, comprising the counties of San Francisco, San Mateo and Santa Cruz.

The following comparative statistics of the old and the proposed routes, will serve to show the great improvement in travel facilities afforded by the new highway:

Route	No. curves	Total curvature	Circles	Curve length % of total	Maximum grade	Total rise and fall	Length miles
Present	250	15193° 51′	42.2	46.6%	7%	2409′	10.618
Proposed	28	1372° 28′	3.8	47.8%	7%	1225′	5.903
Diff'nce	222	13821° 23′	38.4			1174′	4.715

The above figures show that the distance and the rise and fall are practically cut in half.

PRESENT ROAD DANGEROUS

The statistics and map, however, do not tell the complete story. The present road is very narrow, with an average roadbed width of 16 feet, steep cut banks, and extremely sharp curvature, most of the curves being under 100 foot radius. The new alignment has a minimum radius of 400 feet. The old line has a continuous climb of 3 miles, and reaches a summit elevation of 922 feet, only to drop back to the coastal flat on the other side. The new line has a climb 1.2 miles long, with a summit elevation at Station 440 of 465 feet. The new roadway width is a minimum of 26 feet with numerous wider sections for turnouts and parking, particularly on the cliff section between Stations 400 and 440 where the entire ocean side has been daylighted.

Montara, or, as it is locally known, San Pedro Mountain, is a westward spur of the main north and south range dividing San Francisco Bay and the ocean. The geologists describe it as a dioritic batholith, which marches to the ocean in this area and results in the formation of sea cliffs a thousand feet in height between San Pedro Point and Green Canyon. Tremendous pressures convulsed this section and the sedimentary deposits uplifted by the batholith on the ocean front show unbelievable folding and faulting.

RICH AGRICULTURAL COUNTRY

Both north and south of San Pedro Mountain are sections of rich agricultural lands interspersed with a more or less continuous string of suburban development on the narrow coastal flats and valleys extending back into the main range. There are many fine beaches on either side of the mountain. Therefore, from the earliest times, despite the formidable barrier of San Pedro Mountain, means of communication were established between the two sections.

The almost inaccessible cliff face between Devils Slide and San Pedro Point, while offering lower grades, discouraged all the early builders, and therefore the first trails and roads were built farther inland over steep grades and through passes high up on the mountain. The remains of these early endeavors can be found all over the mountainside.

With the advent of the automobile and the need of better communication between the two sections, the county of San Mateo, in or about 1914, constructed the existing route, which was taken over by the State Highway for maintenance in 1933 under legislative action. However, this road, because of its grades, alignment and width, discouraged any large amount of travel in spite of a heavy, latent, metropolitan traffic waiting to take advantage of a modern highway to the beach and recreational areas to the south.

To remedy this situation, Joint Highway District No. 9 was organized to improve, with State aid, the general route of the Coast Highway between San Francisco and Santa Cruz. One of the first studies and projects undertaken was the rerouting of the highway between Rockaway Beach and Farallone City. The route selected by the Joint Highway District's engineers followed, in general, the former roadbed of the Ocean Shore Railroad by way of San Pedro Point; but after contracts were let the construction was bogged down by right of way litigation and was finally abandoned.

HIGH CLIFF OVERCOME

After taking this section of the road over as part of the Ocean Shore State Highway between San Francisco and Santa Cruz, the pressure of the traveling public and the agitation by official and unofficial bodies of the Peninsula, particularly Joint Highway District No. 9, resulted in a thorough reexamination of all possible locations and the final adoption of the present route now under construction.

(Continued on page 4)

Waldo Approach An Engineering Feature of Golden Gate Bridge

By JNO. H. SKEGGS, District Engineer

SAN FRANCISCO'S great Fiesta celebrating the dedication and opening to traffic of the Golden Gate Bridge on May 28 is history.

The Golden Gate Bridge, spanning the deep waters of ocean and bay at the entrance to San Francisco's world-famous harbor, is in full operation and has assumed its place as an enduring monument to engineering skill and the spirit of progress. It stands as a proud and fit companion for the San Francisco-Oakland Bay Bridge linking the San Francisco peninsula with the eastbay mainland.

The opening to the public of the Golden Gate Bridge marked the engineering achievement of what a large portion of a doubting population of earlier years predicted could never be accomplished. Those who doubted were sincere in believing that the obstacles imposed by Mother Nature were too great to be overcome.

BIG OBSTACLES OVERCOME

But the bridge builders surmounted these obstacles with the longest single over water suspension span in the world, with towers one-seventh of a mile high, set four-fifths of a mile apart. What they did will live as long as engineering annals are written.

Now that the tumult and the shouting have died down, the pageantry and parades and the gay revels of Fiesta Week become never-to-be-forgotten memories, it seems but natural for the engineers of the Division of Highways of the Department of Public Works to survey with pleasure the Waldo Approach, the new highway leading to the Marin end of the Golden Gate Bridge, which was the State's contribution to this huge project.

The Marin Approach, popularly called the Waldo Approach, was constructed by the Division of Highways from the north landing of the bridge to a connection with the Redwood



JNO. H. SKEGGS

Highway at Waldo. The total cost of this project, including engineering and rights of way, will exceed $2,000,000.

DIFFICULT ROAD BUILDING

This section of road, traversing heavy mountain slopes for the greater portion of its 3.6 miles of length, ends at the Waldo Junction, in a marsh or tide flat having a depth of soft mud of seventy feet. Mountainous as the terrain is, with all the usual attendant difficulties of construction of cuts and fills of vertical depths up to 150 and 200 feet, even average mountain stability of formation is lacking, and developed slides have required the removal of more than two and one-half million yards of roadway excavation.

The job required a tunnel 1000 feet long with a bore 28 feet 9 inches high on the center line. The roadway width in the tunnel is 42 feet and one sidewalk, 42 inches wide, is provided.

Statistics of costs and of construction quantities, however, have but slight significance to the average citizen. A comparison with past highway construction achievement presents a more vivid picture, and will give a truer conception of the magnitude and economic value of this important contribution of the State to the Golden Gate Bridge project.

WALDO APPROACH JUSTIFIED

When California voted its first bond issue of $18,000,000 for highways back in 1911, each section of completely constructed highway was considered an achievement. The three and one-half mile Waldo Approach, with its 1,000-ft. tunnel and heavy grading, would have built sixty miles of average graded and concrete paved highways of that bond issue. It would have constructed the complete original Redwood Highway from Sausalito to Healdsburg. Applying present-day contract prices to the contract quantities of the construction of those days, the money required to build the Waldo Approach would have graded and paved the original Redwood Highway from Sausalito to Hopland. Another vivid comparison shows that the cost of the Waldo Approach would pay for all the snow removal on 5,000 miles of State highways for four years, using the maximum yearly snowfall ever encountered in the State as a basis for this comparison.

With these comparisons in mind, as an essential part of this great bridge project, without which it could not adequately serve its purpose, the Waldo Approach is more than justified.

MUCH TIME SAVED

The Golden Gate Bridge will save from 24 to 45 minutes in travel time for San Franciscans motoring to northbay points and into the Redwood Empire.

This time saving is really quite tangible, and has an effect of bringing holiday and vacation resorts of the vast Redwood playground from

(Continued on page 12)



Upper picture is of Waldo approach showing one of deep cuts. Inset: View taken from Waldo tunnel mouth looking south towards Golden Gate Bridge. Center: Another stretch of new highway leading to Marin side of bridge with south tower of span in distance. Lower: Parade of official party autos arriving at San Francisco toll plaza after dedication ceremonies on Marin side.



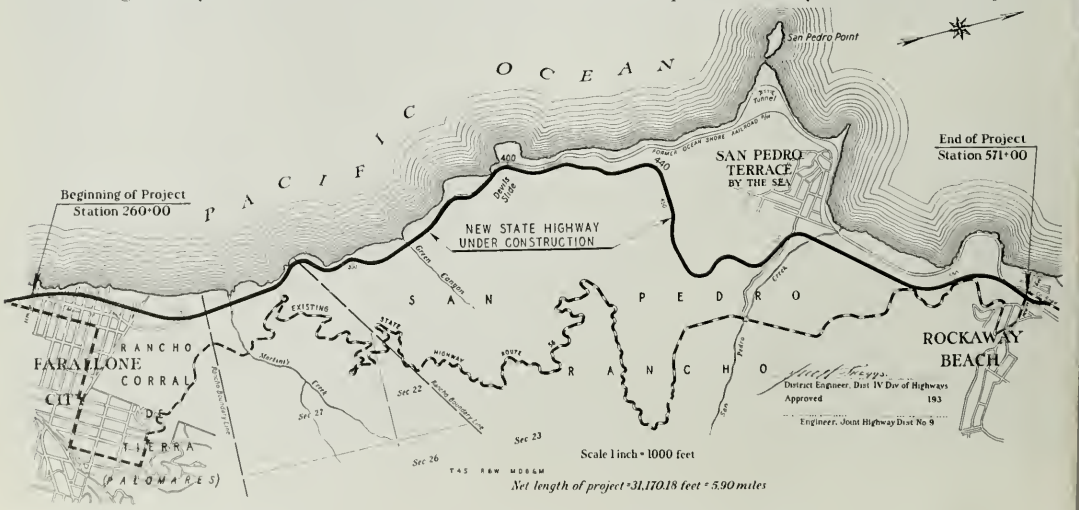
This photograph taken on the south slope of San Pedro Mountain shows type of existing winding and hazardous road which will be eliminated by new State highway now under construction in San Mateo County.

New Pedro Mountain Highway Eliminates Bad Grade

(Continued from page 1)

The undoubted and great advantage of easy grades that could be had by following the more or less level bench above the ocean was offset by the tremendous height of the unstable cliff and the difficulty of good alignment around San Pedro Point. A patient and thorough study of the terrain disclosed a low break in the cliff face about half way between Devils Slide and San Pedro Point. This break resulted from the erosion of a small stream flowing easterly and with its headwaters on the easterly side of the cliff face. Advantage was taken of this break and the location was laid down the face of the cliff from Stations 440 to 400; and in this short distance are concentrated the main construction problems on the project.

The location of the highway along the cliff face required men with the agility of mountain goats, courage, experience, and complete lack of nerves. One false step meant a tumble into the breakers. The contractor's pioneering operations in this area are also an epic in themselves. To launch 15-ton cats into space and carve a precarious foothold in the cliffs could be entrusted only to a few specially skilled and daring cat skinners. That this work was safely accomplished, with only one serious injury, is a tribute to the skill and daring of the men and the contractor. On several occasions shovels, cats and compressors were covered by great slides, but only one worker was injured.



Sketch map shows proposed realignment of Pedro Mountain grade in San Mateo County. Dotted line indicates existing route.



Scenes on Ocean Shore State Highway in San Mateo County now being built. Upper—Section of scenic route which will become modern highway. Center—Stretch of new highway with San Pedro Mountain in distance. Lower—Constructing highway along face of cliff on which engineers constantly battle slides which plunge into Pacific ocean below.

Photo Electric Recorders Make Count of Highway Traffic

By K. A. MacLACHLAN, Assistant Maintenance Engineer

FORTY-SEVEN per cent of the 16.16 billion annual vehicle miles in California occur on the State Highway System. It is of vital importance to the engineers designing highway routes, supervising their construction and maintaining them in condition to render the service demanded of them, that the flow of traffic along these roads and their tributaries be adequately metered.

In the past this has been done by manual count of passing vehicles, using the sampling method. Most of the counts have been 16-hour with some 24-hour records, and occasional 24-hour full week counting. The cost of such sampling has been relatively high, and the samples necessarily limited.

In 1936 in connection with the State-wide highway planning surveys the Bureau of Public Roads drew up specifications and took bids on a device designed to count passing vehicles without human aid. California ordered ten of these counters and they were installed in January and February of this year.

24-HOUR COUNTS

Inconspicuous in appearance, located where traffic proceeds at a normal pace, unlighted, so far as the human eye can detect without close inspection, these recorders are giving the Division of Highways 24-hour counts day after day.

The automatic traffic counter operates on the well-known photo-electric principle. Two parallel beams of infra-red light are projected across the road to a receiving unit housing the counting and printing mechanism. When one of these beams is interrupted by a passing pedestrian no count is made. A vehicle interrupts both beams causing the counter to work. At the end of each hour the machine automatically prints the day, the hour, indicating whether a.m. or p.m., and the cumulative total of passing vehicles.

PHOTO-TUBES USED

The photo-electric tube employs the principle used in all radio tubes, that electric current will flow across space on light waves. When light is present in the ordinary radio tube, that is, when the filament is lighted, current passes across the gap between the filament and plate and actuates the loud speaker. In the photo-electric tube, the light is supplied from an outside source, and reflected into the tube, providing a path for electric impulses between anode and cathode in the photo-tube.

Since infra-red and ultra-violet light have the same ability as white light to provide this current path, it has been possible to use filters on the light source, eliminating visible light, which might prove a traffic hazard at night.

The inconsiderable current passing the photo-cell is amplified to provide energy sufficient to operate a relay at the moment needed to introduce into the circuit the comparatively powerful current needed to operate the counting mechanism.

OPERATION COST LOW

A synchronous motor also operating on exceedingly small current operates the day, hour, and minute type wheels, and by interruption of one of the relay circuits each hour, causes the device to print the total of vehicles counted during the preceding hour. It is thus seen that, except when actually counting vehicles, or printing the hourly totals, the current consumption is very low; in fact the average cost of operation when counting 300 vehicles per hour is about $2.25 per month for current.

The counter needs attention only once a week, when the tape, bearing a printed record of vehicles by hours, by days, is removed. The light source bulbs have a normal life of six to ten months and require only occasional cleaning and inspection. They are ordinary automobile headlight bulbs of 50 candle power.

LOCATIONS CAREFULLY PICKED

Several months were spent in study of the correct locations for the photo-electric counters. Two purely physical limitations existed, namely—the need of an a-c power supply, and the necessity of locating on a two-lane highway to minimize the error due to cars passing each other at the recorder. It was also desirable to locate them near Highway Maintenance Stations so that the operation could be watched and the tape could be removed each week without excessive travel.

It was desired to pick locations which would give hourly and seasonal variations of various types of traffic.

Three counters were located on secondary roads in agricultural areas. One is on Route 50 just west of its intersection with Route 7 near Woodland. Another is located at Somis on Route 153 just below its junction with Route 154. A third counter is east of the city limits of Calipatria on Route 201. These three counters are used to develop seasonal factors representing the fluctuation of traffic in three quite different agricultural districts.

THREE COUNTERS ASSIGNED

Three counters were assigned to primary highways. They are on Route 3 just south of Redding; at the San Joaquin River Bridge on Route 4 between Madera and Fresno; and just west of the junction of Route 26 and Route 187 at White water.

A combination of through and recreational traffic is registered by the counter near Ukiah on Route 1 just north of the junction with Route 15. A counter in the Santa Ana Canyon on Route 43 provides a profile of through traffic also, but combines it with an agricultural factor of considerable importance. The Santa Ana Canyon record also reflects some of

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Upper picture shows automobile passing between traffic count machines on each side of road and being registered automatically. Center left: Close-up of one of traffic count devices. Center right: Shows counting machine open and member of Maintenance Department staff reading ticker tape count. Lower: Automobiles have just passed through two parallel beams of infra-red light projected across road as indicated by dotted line.

Governor Dedicates Link in Roosevelt Highway in South

By P. A. McDonald, Assistant Engineer

COLORFUL ceremonies in which Governor Merriam, a "Queen," scores of civic leaders and several bands participated were held Saturday, June 5th, to open officially the "Wilmington link," the final section of State Highway Route 60, completing Roosevelt Highway in Los Angeles County, between the cities of Santa Monica and Seal Beach. This through traffic artery, thirty-six miles in length, has been constructed since 1932 at a total cost to the State of $4,425,000.

Route 60 is one of the original State highway routes, having been adopted by the Legislature in 1912 as a primary State Highway, but it was not until 1932 that an extensive program was undertaken to improve this route within Los Angeles County.

VALUABLE LINK

Prior to this time many stretches of the then existing traveled way were of very inadequate 20-foot wide pavement. No direct route was then available and traffic was forced to detour over the existing county roads and city streets. As this section of highway serves the beach cities and closely parallels the ocean, it is important, not only from a local standpoint to each community, but is important as well in that it carries traffic through the lesser congested sections of the beach cities comprising a most valuable link in the Roosevelt Highway (U. S. No. 101-Alt.), leaving the "Coast Route" (U. S. No. 101) at Oxnard, in Ventura County, and joining it again at Serra, near San Juan Capistrano, in Orange County.

Governor Merriam cut a blue and gold ribbon which was carried away by little Christine Book and Lou Ellen Traller, following an hour dedication program at the Avalon Boulevard intersection of the new highway. The dedication ceremonies were attended by some five hundred persons, including representatives from many civic organizations, and government authorities.

DIGNITARIES PRESENT

The Governor, Chairman Harry A. Hopkins, Commissioners P. A. Stanton and Wm. T. Hart of the California Highway Commission, accompanied by Assistant Director Justus F. Craemer, Harold F. Norton, and District Engineer S. V. Cortelyou represented the Department of Public Works.

Present also were Supervisors Leland Ford and Gordon L. MacDonough, of the county of Los Angeles, E. J. Amar, President of the Los Angeles Board of Harbor Commissioners; Mayor Colfax Bell of Redondo; Mayor Tom Eaton of Long Beach; Charles Bland, Long Beach harbor commissioner; Walter Gillman, representing Sheriff Eugene Biscailuz; Edith Smith, Tom Blair, Ray Baldwin, and Mrs. J. R. Parkhurst, President of the East Wilmington Property Owners Association, all early organizers and workers for the highway; as well as a host of others.

Attending also was a representative of the Canadian Government, Mr. John Playfair Price, His Britannic Majesty's Vice Consul. Telegrams of congratulation were received from Director Earl Lee Kelly and Deputy Director Neron expressing regret in not being able to attend.

Councilman Franklin P. Buyer was chairman for the day of festivities, which were staged jointly by the Wilmington Property Owners Association and the American Legion, Robert Hillyer, commander. Supervisor Leland Ford was master of ceremonies.

GOVERNOR MERRIAM SPEAKS

Governor Merriam delivered the main address and told of his long interest in this highway, first as a member of the State Assembly, later as speaker of the Assembly, then as Lieutenant Governor, and now as Governor. He recalled the proposal to build a highway along the Pacific Ocean, from San Francisco to San Diego, as an objective in front of the Legislature twenty years ago. To this end, bond issues were approved and a small beginning was made. Although those first highways have disappeared, with the original bonds still standing, the entire project stands completed today, and paid for out of the gasoline tax.

The rapid development of highway traffic was stressed, and he predicted that before this year is passed there will be registered, for operation on the highways of the State, two and one-half million vehicles.

"California already has more vehicles than any other State in the Union. The resources of the State Division of Highways are constantly employed to keep up with this ever increasing demand," the Governor stated.

Governor Merriam then spoke of the benefits to the communities of such expenditures, and how four hundred million dollars collected through the gas tax have been spent in this State on highway construction.

"You have provided for yourselves, out of gas tax revenues, a great opportunity for travel and traffic for every community of the entire State of California," the Governor said in conclusion.

MUSICAL PROGRAM

Preceding the program of speaking and the introduction of many prominent guests, musical numbers were given by the Phineas Banning High School Band of Wilmington, and the Swiss Yodler Family, a very talented and colorful group in their Swiss mountain folk costumes.

Following the dedication ceremony, all of the officials and friends of the project were present for a dinner at the California Yacht Club. Governor

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Scenes at dedication of Wilmington link of State Highway Route 60, completing Roosevelt Highway between Santa Monica and Seal Beach. Upper—Governor Frank F. Merriam cuts ribbon throwing new road open to traffic. Left to right: Councilman Franklin P. Buyer, chairman of the day; E. J. Amar, president of Los Angeles Harbor Commissioners; State Highway Commissioner W. T. Hart, Governor Merriam, Harry A. Hopkins, chairman State Highway Commission; Supervisor Leland Ford, Los Angeles; Highway Commissioner Phil A. Stanton, District Highway Engineer S. V. Cortelyou, Assistant Director of Public Works Justic F. Craemer. Ribbon girls with Governor are Christine Book and Lou Ellen Traller. Center—Section of new highway looking towards Long Beach. Lower—View of speakers' platform at dedication ceremonies.

Uniform Pavement and Traffic Signs Great Aid to Motorists

By F. M. CARTER, Assistant Maintenance Engineer

IN THIS, the sixth and concluding article in the series on California highway signs, we take up the temporary and pavement signs and traffic signals.

Uniformity in the wording and positioning of temporary signs is just as imperative as for the permanent signs previously discussed. Inasmuch as these temporary signs give warning and indication of potential hazards not expected and at unusual places, it may be said that it is quite important that these temporary signs be uniform and consistently placed. These signs should be recognized and obeyed by the motorist.

Because of the fact that these temporary signs may be placed at places such as long tangents where the motorist through familiarity has been accustomed to fast traveling, it is very important that the temporary signs are placed only when necessary and removed immediately when their use is no longer required.

STANDARD COLOR AND SHAPE

It is necessary therefore that the construction and maintenance crews using these temporary signs become sign conscious so that these signs will not be abused.

In the same manner it is equally as important that standard color, wording and shape, as well as positioning be observed by all users of these signs. When this consistent use and removal is obtained, more respect will be obtained.

Probably the most important temporary sign is the MEN AND EQUIPMENT WORKING sign. These are supplemented with a red flag and are the only protection the workmen have. These signs should slow down the traffic so that a full stop may be made quickly. While the general observance of the motorist is good, full cooperation is not being given and steps will be taken to see that the reckless driver who does not observe these protective signs is made aware that they are placed to be obeyed.

DETOUR SIGNING

On construction and maintenance where detours from the highway are necessary, standard uniform signing is required as follows:

1000 feet in advance of the barricade where detour starts the STATE HIGHWAY UNDER CONSTRUCTION sign is placed. If a bridge, then BRIDGE UNDER CONSTRUCTION.

At 800 feet, the DANGEROUS BUT PASSABLE.

At 600 feet, a CURVE sign right or left 90° or if tangent on detour is less than 200 feet, then a reverse curve sign right or left.

At 400 feet BEGIN DETOUR 400 FEET.

If a narrow road is used for detour, a NARROW ROAD sign is placed at 200 feet.

At the barricade a ROAD CLOSED, a 9 unit red reflector head-on sign and a W46R reflectorized arrow sign.

If it is a long detour passing over city streets or county roads, then a reflectorized directional sign is placed on the barricade and CURVE signs are placed in advance of all turns with DETOUR signs with an arrow at the point of turning. When a detour is made over a US or State Sign Route, it is customary to erect US or State shields bearing small plates reading DETOUR to mark the temporary routing.

OTHER TEMPORARY SIGNS

When returned to the main highway again an END DETOUR sign informs the motorist that the detour is completed.

Other temporary signs placed to advise the motorist of unusual conditions are the SLIPPERY, SOFT SHOULDER, FRESH OIL, et cetera. The wording, color, shape and positioning of these signs has been standardized and the signs are removed when the condition is cleared. Inasmuch as the majority of these signs are the SLOW type warning sign, diamond shape, strict observance should be given by the motorists.

PAVEMENT MARKINGS

The painting on the pavement is always open season. Everyone has ideas which can be put on a pavement with white traffic lacquer. In many localities all sorts of pavement markings are made. It would appear that everything suggested is tried and while some of the markings have considerable merit, their use as a standard is ruined because of their lack of definiteness.

When some new pavement marking is placed, it immediately presents an unusual appearance. The motorists, because of the surprise effect, tend to slow down and give the impression of obedience. In many cases the motorist does not know what the marking means.

Because these markings are apparently a success when first tried they are immediately painted for everything and through this inconsistent use the motorist soon learns that he has been duped again and he ceases to give any attention to the markings.

USE IS SPECIFIC

This is the reason that many apparently worthy ideas have not been adopted as standard.

The standard State Highway pavement markings have been held to a minimum and their use has been definite and specific.

The most common pavement marking is the white traffic lane to guide and advise the motorist in daylight, darkness or fog. It is the most important of all methods for assisting traffic.

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Pavement and Traffic Group of Highway Signs

Standard sign to warn motorists they are approaching construction work on highway.



Standard sign to inform traffic of bridge under construction. These first two signs are placed approximately 600 feet in advance of construction work.



A warning sign erected following the above signs to notify traffic to proceed with caution.



Pavement markings placed 400 feet in advance of an intersection to call attention in advance to the presence of a STOP sign.



Standard pavement marking for a school crossing. Motorists should pay particular attention to this sign, especially during periods when schools are in session.



Standard pavement marking for Pedestrian Crossing other than at a school. Strict observance of this sign by motorists will tend to lessen pedestrian accidents.



Uniform Traffic Signals

The State of California has in general adopted the Manual on Uniform Traffic Control Devices as issued by the Bureau of Public Roads, The American Association of State Highway Officials and the National Conference on Street and Highway Safety.

The use of traffic signals is very carefully explained in this manual.

Of all other traffic control devices it is imperative that the motorist should be presented with the same appearance of traffic control signals in the same position. It is very important for lack of observance means serious accidents.

The standard as approved by the foremost traffic experts and described in the manual is the three light type for far right hand corner installation.

UNIFORM SIGNALS

The question as to whether some other signal is not better or some other positioning would give better view is not the issue.

Many different organizations as well as traffic engineers met and discussed every favorite scheme and device and have given up each pet idea to form a standard uniform installation, all of which is described in the Manual.

In considering what should be adopted as uniform, it was necessary for the experts to choose a traffic signal which could be used everywhere in the United States—in cities where expert mechanics and electricians are available or in some remote rural area. It was for this reason that the standard type as approved by the manual was adopted.

PROBLEM NARROWED

The advantages of uniformity is quickly realized by the traveler. What a relief when he finds everywhere he knows just what the speed laws are, where he will find his warning informaiton and guide signs, and where he will look for his traffic control signals.



Used to mark a Temporary Detour routing. This sign is accompanied with an arrow sign at turns showing direction traffic is to follow.



Standard sign placed as the name indicates.



Placed on a barricade when a highway is closed for repair or construction.



Placed following sign 1 and in advance of detours.



Used extensively and accompanied by a red flag when maintenance crew is improving our highways. Traffic should proceed with caution when this sign is displayed.



Pavement Marking used in connection with STOP sign.

Pavement Markings for Railroad Grade Crossing. Markings are the same on each side of track.



California's Chief Executive formally dedicates Waldo Approach to Golden Gate Bridge, broadcasting his words over a nation-wide radio hookup. Left to right: Highway Commissioner Paul Jasper; Harry A. Hopkins, Chairman of Highway Commission; Governor Frank F. Merriam; Director of Public Works Earl Lee Kelly

Governor Opens Waldo Approach To Gate Bridge

Dedicating the Waldo Approach to the Golden Gate Bridge, constructed in the mountainous country of northern Marin County by the State Division of Highways, Governor Frank F. Merriam, at ceremonies held on the Approach on the morning of May 28, said, in part:

THE HISTORY of nations is quite accurately written in their roads and the means of transportation of their times. Through the centuries, the genius and perseverence of the road builder have determined the borders of nations and have given direction to the course of commerce and civilization.

America and California are outstanding examples. The adventurous blazed a trail, and following came the pioneers in constantly increasing numbers as facilities for transportation were lengthened and the barriers of mountain and stream removed.

Few, if any of that time even dreamed of today's accomplishment. The present heights were not reached at a single bound. By slow and constant processes and experiences, from the primitive trail marked by the

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Marin Approach Built by State

(Continued from page 2)

20 to 35 miles closer to San Francisco. This will have a tendency to bring new resort territory within reach of summer week-end travel—will tend to reduce the irritation of the slow surge of stopping and starting progress toward present ferries on the Sunday night return home—and will relieve the minds of motorists of a feeling that they must start home early to avoid a traffic jam.

Many hours of additional enjoyment will be afforded to all, in the assurance that they will be able to cross the bay at any time of the night or day in a steady stream of traffic.

FACTOR IN NATIONAL DEFENSE

As a contribution to the national defense of our country during time of war, and as an economic advantage to the military and naval garrisons in time of peace, the influence of this highway project is not easy to analyze. In time of war, the events of minutes might influence the developments of centuries.

Suffice it to say that the Presidio of San Francisco, the headquarters

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State's Share of Bridge Project Is New Highway

Speaking at the dedication of the Marin Approach to the Golden Gate Bridge on the morning of May 28, Earl Lee Kelly, Director of the Department of Public Works, which constructed the highway leading to the span through its Division of Highways, said, in part:

THE State of California today joins happily with the Golden Gate Bridge and Highway District and the counties of the great Redwood Empire in dedicating the world's longest suspension bridge.

Standing here this morning we can see the two monumental structures that represent fulfillment of long-ago dreams of California Argonauts. Off there to the east is the San Francisco-Oakland Bay Bridge, the largest over-water span ever constructed, concrete realization of a vision of San Francisco's pioneers. It was built by engineers of our own State Division of Highways with public funds and dedicated to public use.

Below us in all its structural beauty is the splendid span across the Golden Gate. It will stand an everlasting tribute to that valiant band of citi-

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Gate Span Approach Opened By Governor and Director of Public Works

(Continued from page 12)

of the Ninth Corps Area of the United States War Department, will be from 36 to 46 minutes closer to the Mare Island Navy Yard, Marin Bombing Base (Hamilton Field), Fort Barry and Fort Baker in the North Bay, than at the present time. These north bay reservations will enjoy comparable savings in travel time with Forts Scott, Miley, Funston, Mason, and the Sunnyvale Air Base on the Peninsula. The Marin Approach is a vital factor in these considerations of national defense.

The Redwood Highway, with which the northern bridgehead approach connects at Waldo, is an arterial of major importance in the California State Highway System, officially designated as State Highway Route 1 and U. S. 101. It not only serves as a commercial outlet for the fertile agricultural areas in the valleys of Marin, Sonoma and Mendocino counties, but leads into the heart of the great Redwood Empire of the northern California coast country in Mendocino, Humboldt, and Del Norte counties.

INTO REDWOOD EMPIRE

It also provides connection between Crescent City and the Pacific Highway at Grant's Pass, Oregon, and via State Route No. 71, connects with Oregon's Coast Highway at the State line near Smith River. With the recent completion of five major bridges on the Coast Highway in Oregon, eliminating five former State-operated ferries, the Redwood Highway provides a direct continuous scenic coast trip from San Francisco to Portland and points north via Astoria or McMinnville.

The Redwood Empire stretches from San Francisco to Grant's Pass, Oregon, and ranks with national parks as a world attraction. It includes the counties of San Francisco, Marin, Sonoma, Napa, Lake, Mendocino, Humboldt, and Del Norte in California, and Josephine County in Oregon.

Over $54,000,000 have been spent by the Division of Highways and these counties within the Redwood Empire. Difficult engineering feats characterized the construction of many of these roads. Stream beds were moved, rock cliffs and mountains blasted, deep canyons and wide rivers bridged, big trees felled and acres of dense forest undergrowths cleared. These hard-surfaced all-year highways lead into one of the most attractive vacation lands in the world.

BEAUTY SPOTS SERVED

San Francisco and her sister counties with their innumerable beauty spots will be served by the Golden Gate Bridge.

Construction of the Redwood Highway from Sausalito to the Oregon line to make it conform to modern standards of alignment, grade and width has been a foremost consideration in the general program of the State Division of Highways, with the result that the entire route has now reached a high standard, especially the southern portion of one hundred miles between Sausalito and Hopland.

The completion in recent years of the braided crossing at Manzanita adjoining Waldo on the north, the Richardson Bay Bridge, the Greenbrae, Corte Madera and California Park bridges and highway on new location, saving four miles over the former route to San Rafael, is a notable example of a portion of this progress.

Other portions of the State Highway System served by the Redwood Highway and the new Waldo Approach include the Black Point Cutoff, taking off at Ignacio, eight miles north of San Rafael and leading to Sonoma and Jack London's famous "Valley of the Moon," or to Napa and Calistoga's hot springs and spouting geysers, the extinct volcano of Mount St. Helena and Lake County's beautiful Clear Lake country, so aptly named "The Switzerland of America."

OTHER ROUTES

Another beautiful highway vacation route leaves the Redwood Highway at Cloverdale, proceeding in scenic mountain country to McDonald,

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Huge redwood logs forming barrier across Waldo Aporoach to Golden Gate Bridge were sawed apart by champion saw wielders at close of ceremonies dedicating new span across entrance to San Francisco Harbor on May 28, 1937.

Road Compacting With Crane and Ball Cuts Highway Costs

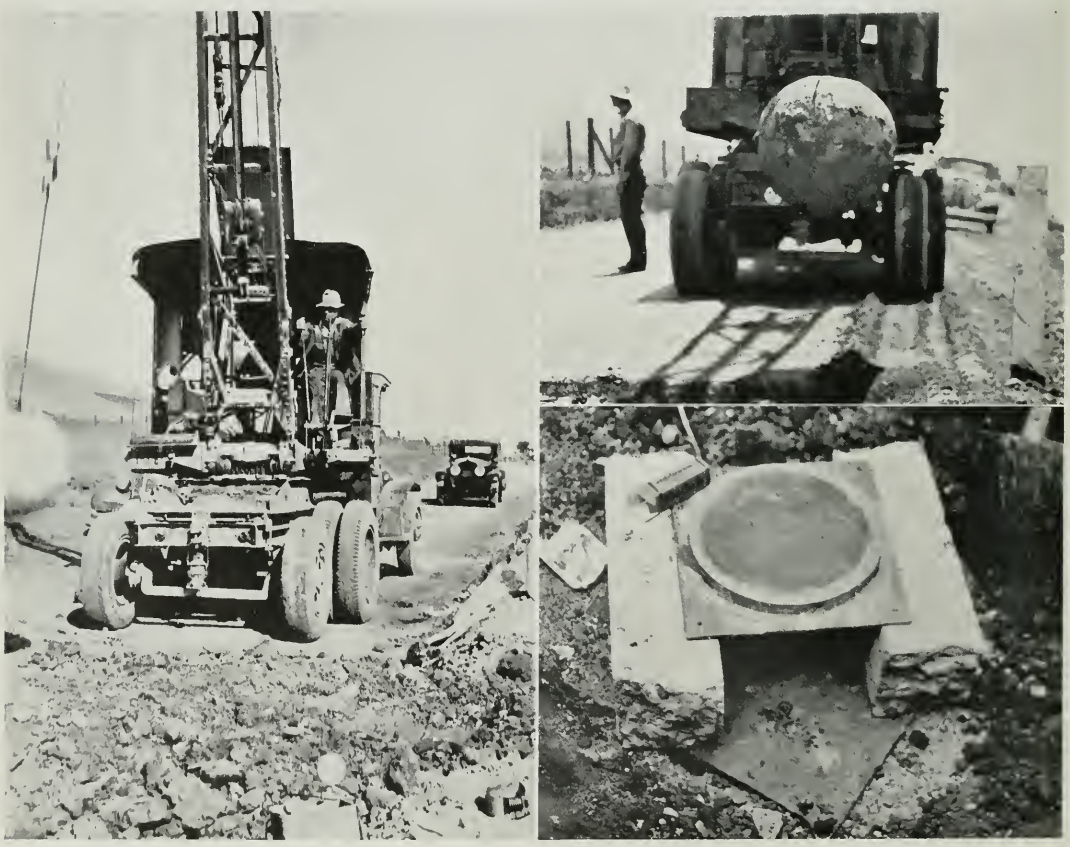
By VICTOR E. PEARSON, Resident Engineer

EXPERIMENTS with a crane and ball method of compacting old highway end-dump fills which had not yet reached a state of equilibrium have proved eminently satisfactory on a section of the Coast Highway in Santa Barbara County.

Recent reconstruction work performed on a 3.1-mile section south of Gaviota by Granfield, Farrar & Carlin, contractors, required the compaction of several end-dump fills. It was planned to remove these old fills to a depth where a relative compaction value of 90 per cent had been developed by settlement under gravity, and then replace and recompact this material by accepted methods of embankment construction.

A portable crane and 2500-pound iron ball was used by the contractor to break out the old existing pavement, and it was noticed that in vari-

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The picture on the left shows portable crane with 2500-pound iron ball attached which is used to break out old highway pavement. Upper right: Iron ball in place on crane truck for transportation. Lower right: Pressure cell on steel plate and concrete blocks placed eight feet below grade to test compaction strength of ball.



View of stretch of newly completed Vacaville By-Pass constructed to route highway away from schools and congested business district in city of Vacaville.

Vacaville Highway Open to Public

By R. E. PIERCE, District Engineer

THE VACAVILLE BY-PASS, opened to the public this month, eliminates another bottle-neck on this important highway from the State Capital to San Francisco and the bay region.

In addition to keeping the through traffic out of the business district of Vacaville, it also removes the hazard caused by both the grammar and high schools being located on the old route.

While this by-pass is slightly shorter than the present tortuous route through the city, the principal advantage to through traffic will be in reducing hazard to pedestrians, particularly school children and to the saving of time due to the easy grades, direct alignment, long sight distances and lack of congestion which now exists on the present route.

This is the fifth project involving realignment on this route between the Carquinez Bridge and Sacramento, which have made savings in the distance between these points.

These listed in order of completion, showing savings in distance, are as follows:

Cordelia Cut-off	**0.40 miles**
Cordelia-Fairfield Cut-off	**0.75 miles**
Orchard Line Change	**0.75 miles**
American Canyon Cut-off	**6.00 miles**
Vacaville By-pass	**0.14 miles**
Total Saving	**8.04 miles**

Possible future changes could reduce the distance by 6 more miles, making a total reduction of 14 miles.

The twenty-foot Portland cement concrete pavement built in two 10-ft. strips and tied together with tie bolt assemblies is of Class "B" concrete 0.55′ thick, increasing to 0.75′ at the outside edge of each strip, starting from a point 2′ from the edge.

The pavement is bordered by road oil mix surface treatment 3′ wide by 0.25′ thick, except that at two railroad grade crossings, for a distance of 300 feet each way, the pavement is bordered by plant asphalt mix surfacing 10′ wide by 0.25′ thick.

CONCRETE BRIDGE BUILT

The subgrade is oil treated upon which was placed before the pavement was laid selected material varying in thickness from 0.5′ to 0.9′.

A reinforced concrete bridge with concrete piles has been constructed over Ulatis Creek. The bridge has a center span of 30′ with a 23′ span on each side of the center span.

The two railroad crossings are each protected by two flashing type signals, as well as two advance overhead illuminated R X R signs, the lights of which are actuated when trains approach the crossings.



View of section of crowd gathered to witness dedication of Waldo approach to the Golden Gate Bridge.

Governor Opens Approach to Bridge

(Continued from page 12)

courageous pioneers, ridden by the pony express and constantly developed by the settler, this great accomplishment is the result of obstacles overcome and the application of science in the preparation of plans, the selection of materials and the art of construction.

The achievement we celebrate today is the direct result of cooperation of the six coastal counties of the Redwood Empire which have combined their energies as communities and pledged their resources in the removal of a barrier to travel, and the exchange of products.

The economic value of improving highways fully justifies the expenditures made annually in maintenance and construction. The saving in time, the cost of each mile traveled and the less wear on the machine and tires furnish a definite yardstick for determining the value of any highway. This, multiplied by the number of vehicles traversing it daily, indicates the time necessary for a road to repay its cost to the motorist who supplies the funds, through the gasoline tax, for such enterprises.

This work is carried on under the direction of the Highway Commission of five members and the Director of Public Works, Hon. Earl Lee Kelly. My congratulations to the people of the state upon the splendid personnel and ability of the highway officials, and upon their fine accomplishments.

Gate Span Approach Opened by Governor

(Continued from page 13)

thence through Boonville and the Redwoods of the Navarro River to the sea, Fort Bragg and other North Coast points.

All the preceding well defined system of State roads, and all connecting county roads will receive the full benefit of the Golden Gate Bridge. Passing time only will reveal all the factors of influence, and the economic contribution, to the development and welfare of San Francisco and the Redwood Empire of Northern California.

The San Francisco-Oakland Bay Bridge has linked San Francisco with the mainland on the east with all its transcontinental arteries of commercial and tourist traffic, and now this noble span vaulting the waters of the Golden Gate brings into close union the famed metropolis of northern California and the vast Redwood Empire country, whose possibilities of development challenge our imaginations.

The Golden Gate Bridge removes the last major water barrier on the Redwood Empire and Pacific Coast highway systems between Canada and Mexico. It closely links eight northbay coastal counties with San Francisco. It breaks the water-bound isolation of the San Francisco peninsula. It is, indeed, a fit companion for the great San Francisco-Oakland Bay Bridge which connects the Eastbay Empire with San Francisco.

State's Share of Bridge Project

(Continued from page 12)

zens of San Francisco, Marin, Sonoma, Napa, Mendocino and Del Norte counties who through the years clung steadfastly to their purpose and who today see the vindication of their faith and tireless efforts.

STATE'S CONTRIBUTION

Climaxing its own achievement in bridging the bay from San Francisco to Oakland and her sister cities, it was a high privilege for the State of California to participate in the project whose completion we celebrate today. The State, through its Division of Highways of the Department of Public Works, has had the honor of constructing the Marin Approach to the Golden Gate Bridge. We call it the Waldo Approach.

The State's contribution, the Marin Approach, an outstanding engineering achievement, extends from the north landing of the Golden Gate Bridge to a connection with the Redwood Highway at Waldo. The total cost of this approach, including engineering and rights of way will exceed $2,000,000.

The economic influence of this great project in welding Marin County into the great Bay Area metropolitan district cannot be overestimated, nor can we fully foresee the influence which this project will have in moving all the Redwood Empire coastal counties closer to San Francisco.

Property of Seattle Public Library

Tortuous Humboldt Highway Being Modernized By State

By J. C. BLACK, Chief Draftsman District I

WITH work now 50 per cent complete, the reconstruction of the portion of the Redwood Highway between Trinidad and McNeill's Ranch in Humboldt County is proceeding at a satisfactory rate which should assure completion of the project by September of this year.

Designed to thoroughly modernize the tortuous, sharp alignment at Mill Creek, near the beginning and at McNeill Creek near the end of the project, and to greatly improve the rolling grades of the existing highway, the present project is of the greatest importance in improving road transportation conditions on this section of the Redwood Highway.

Eight hundred feet in length, 389 degrees of curvature, and one hundred sixty-two feet of rise and fall will be eliminated in a distance of 2.3 miles. The new roadbed will be thirty feet wide of special section which substitutes a rolled gutter for the old type, hazardous side ditch Poulos and McEwen are the contractors.

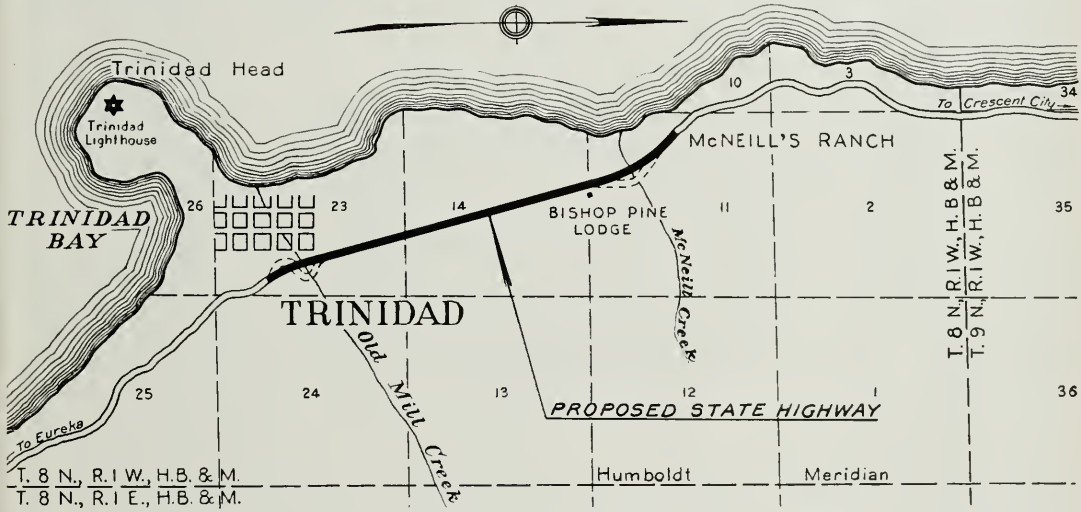
There are no local deposits of gravel that comply with the grading requirements of the standard specifications for mineral aggregate for bituminous treated surfacing. Suitable rock for crushing is available, but the cost of production for so small a project would be prohibitive. There are, however, numerous deposits of ancient beach gravel and beach sand exposed in roadway cuts within a short distance of the project. This material is much finer in grading than the material generally used as mineral aggregate in surfacing. However, samples were submitted to the Materials and Research Department and test results indicated the possibility of developing a satisfactory base and oil mixed surfacing.

Based upon these reports several test sections of surfacing, using a combination of these materials, were constructed by State forces in 1936. One of the test sections was constructed using approximately 80% of the beach gravel and 20% beach sand, road-mixed with liquid asphalt, and although constructed under adverse weather conditions, has shown that a good, economical surfacing can be obtained with the materials and this type of surfacing has been set up for use on the project now under construction.

The full width of roadbed, including the gutters, is to be surfaced with road mix and sealed with a Class "B" seal coat.

Juan Bodega discovered and named Trinidad on June 9, 1775, taking possession of the country in the name of King Charles II of Spain. Trini-

(Continued on page 20)



Sketch map shows proposed relocation of portion of Redwood Highway between Trinidad and McNeill's Ranch in Humboldt County now under construction.

Public Works Department Moves Into New Building

By GEORGE B. McDOUGALL, State Architect

CALIFORNIA'S Department of Public Works moved this month into its new home, the State's latest administrative building at Twelfth and N streets in Sacramento.

Crowded conditions in the old headquarters at Eleventh and P streets necessitated erection of the new structure to house the Division of Highways, Division of Water Resources, Division of Architecture and Division of Contracts and Rights of Way, together with the headquarters staff of the Department.

Due to expanding highway construction and the large increase in highway mileage effected by legislative enactment, the engineering force of the Division of Highways for several years has been working in cramped quarters in the old building. In the new home the drafting, mapping and planning engineers of the Division have the room and equipment for scientific work they require.

NO COST TO TAXPAYERS

The new Department of Public Works building, as well as its sister structure housing the Department of Motor Vehicles, was built without cost to California taxpayers. Prior to moving last year, the Department of Motor Vehicles had been paying rent to the Public Works Department at Eleventh and P streets. At the rate its rentals were accruing as an equity in the Public Works Building it would not have been long before Motor Vehicles would have owned the building and the Department of Public Works in turn would have had to begin paying rent to the Motor Vehicle Department.

As a result of this unusual situation, Governor Frank F. Merriam, Director of Public Works Earl Lee Kelly and Finance Director A. E. Stockburger decided to let each department erect its own building and pay for the same out of their respective equities in the Eleventh and P streets structure and savings they would effect in rentals. The Department of Finance bought the equities of the two departments and other State agencies will be housed in the old headquarters.

BUILT FOR SCIENTIFIC WORK

Architecture as a fine art has a language of its own and you naturally look for and find so-called monumental characteristics in the design and plan of the Capitol Building with its classical Corinthian order and crowning dome and lantern, which to all of us speak of the actual seat of the government itself, as personified in the Governor and other elective officers, and the legislative chambers of the Senate and Assembly, and corresponding characteristics also, subservient to the Capitol itself, in the Library and Courts Building and its companion structure, the so-called State Office Building.



New Public Works Building at Twelfth and N Streets, Sacramento, California

The design of the building is in the modern manner and the plan is in the form of the capital letter "H" with the result that when the thinking person looks upon it either as a whole or in detail he will, independently of any technical knowledge he may have, automatically understand what the nature of its occupancy is and when he observes the interior arrangement as a whole or in detail, he will with equal facility understand that there is practically no space in it which is not available for the doing of efficient scientific and technical work.

Dignity, beauty and charm are present in all the characteristics of the building. The force of these characteristics is not lessened but rather emphasized and intensified by the simple lines of the exterior and the directness of the plan arrangement of the interior.

REINFORCED CONCRETE STRUCTURE

The building is of reinforced concrete construction including its skeleton frame. Due to the exactness with which the manufacturer of reinforced concrete is controlled, the resulting four-story building is as sound structurally with reference both to vertical and horizontal loads as though its skeleton frame had been fabricated from structural steel shapes at considerably greater expense. Provision has been made for the addition of a future fifth story. The entire building is air conditioned for proper cooling in the summer and warming in the winter and scientific acoustical treatment has been applied throughout.

The citizens of California and those of Sacramento in particular may be assured that this building with its sister structure, the Motor Vehicle Building, measures up to the loveliness of our beloved capital city of Sacramento and to the dignity and power of the sovereign State of California.

"My wife can be an angel when she wants to be."

"Mine, too—any time, now."



Palm sentineled vista of entrance to new Public Works Building in Sacramento as seen from Capitol Park.

Governor Dedicates Link in Roosevelt Highway in South

(Continued from page 8)

Merriam was unable to attend the evening festivities, including the dinner, a parade, and concluding ceremonies held at the Wilmington Women's Club under the auspices of the Wilmington Post of the American Legion, but was ably represented by Assistant Public Works Director Craemer.

The parade from the California Yacht Club to the Wilmington Women's Club was a very colorful spectacle, with several legion posts taking part. Thousands of residents and out of town friends lined the streets to cheer the marching units, led by the three times national champion bugle and drum corps of the San Gabriel Post.

CORONATION OF QUEEN

Other uniformed bodies also taking part in the parade were: Redondo Beach Corps, Long Beach Post Band, Santa Monica and Santa Ana Corps, Cleveland's Boys' Band of San Pedro, North Long Beach Auxiliary Drill Team, Phineas Banning High School Band. Trucks from the fire department and units from several other organizations also took part.

Following the parade to the Women's Club, approximately thirty-five hundred persons witnessed the coronation of Miss Virginia Parkhurst, "Queen of the Highway," surrounded by her ladies in waiting. Miss Parkhurst had previously been chosen through a contest conducted by the Wilmington Post of the American Legion, and is a junior at Banning High School.

A miltary ball was the concluding event on the highway dedication program, presided over by the "Queen" and her six ladies in waiting.

California motorists consumed 1,459,993 gallons of gasoline in 1936 to lead all States with the exception of New York, Federal statistics reveal.

An itinerant musician was stranded in a village one Sunday morning, and, as he was playing his cornet in the street, he was approached by the clergyman of the parish, who said: "Do you know the Fourth Commandment, my good man?"

"No," the man replied, "but if you'll just whistle it over, I'll do my best."

Men of Division of Highways are Paid Compliment

Motoring down the broad highway in good weather the average motorist seldom gives a thought to the toil and foresight that went into the planning, the construction and the maintenance of the smooth ribbon that unrolls under the wheels of his machine.

But it is a different story when trouble comes along. As, for example, when stormy weather hits the highways; when torrential rains wash out sections of the road; when trees or slides block the route; or, occasionally when deep snowdrifts make travel impossible. Then the motorist becomes, suddenly, acutely "road-conscious." And it is then that he begins to really appreciate the work that goes on daily, endlessly, year after year, in the maintenance of the public thoroughfares.

In California, the State Division of Highways is responsible for keeping the highways clear at all times. Fair weather or foul, it is their duty to see that the roads are kept open and that travel may continue uninterrupted. Under blazing sun or in the midst of a swirling blizzard the men who comprise the maintenance section must play their daily role, often forsaking family and fireside to work long hours overtime to patch up some particularly dangerous sector of the route.

Those who carry on that important work may be heroes unsung, but they may rest assured that their work stands for itself, beyond the need of mere human acknowledgment by thoughtless humans who too often take such things for granted.—*Eureka Standard.*

Note from teacher on Betty's report card: "Good worker, but talks too much."

Note from father over signature on back of card: "Come up sometime and meet her mother."

Humboldt State Highway Being Modernized

(Continued from page 17)

dad was first settled by white men in 1850 and grew rapidly, having a population of over 3000 in 1852 when the gold placer mines of the Trinity River were being operated, and was at that time the county seat of Klamath County. Two years later the population dwindled to practically zero and at the present time there are only 107 inhabitants.

Little did those early settlers imagine that at one time a wide surfaced highway would be constructed through the village with between three and four thousand mechanically operated vehicles, called the automobiles, passing every day. Served for many years by a county constructed wagon road, the residents probably believed that the highway built by the State through Trinidad sixteen years ago was "the last word" in highway construction. They did not realize that traffic would increase so rapidly that the then new highway would become obsolete in relatively so short a time.

Of particular interest from a construction standpoint on this new project are the methods being used in stabilizing embankments and the type of surfacing being constructed.

The new highway crosses an unstable area at Mill Creek on a fifty foot fill. Trenches were excavated from twenty to twenty-five feet deep through this unstable area and backfilled with quarry rock, with 18-inch perforated metal pipe underdrains placed in the bottom of the trenches. More than 3000 cubic yards of quarry rock were used in the backfilling.

Hitch-hiking has just been made illegal in Long Beach following robbery of a local motorist who had picked up a thumb-jerking walker. Numerous "Good Samaritans" have been held up at gun point in payment for their generosity and many pedestrians have met with the same fate after accepting rides from strange motorists.

A small boy was asked to write an essay in as few words as possible on two of life's greatest problems. He wrote, "twins."



Upper picture is view of section of highway between Trinidad and McNeill's Ranch looking north across Mill Creek showing rolling grade of existing road, which is being realigned. Lower: Redwood stumps which were removed to widen highway.

Evolution of Traffic Stripe Marker


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EVOLUTION of the highway traffic stripe marking equipment of the Division of Highways since the early 20's has been rapid and revolutionary.

The first machine used to paint white traffic lines on roads was a home-made, hand operated one invented by engineers of District IV of the Division of Highways.

Photo No. 1—On this machine the paint was deposited in a reservoir attached to the frame and flowed by gravity through a rubber tubing to the pavement immediately ahead of a paint brush which spread the paint on the road. At this time, most of the striping was confined to curved sections of roadway. It soon became obsolete.

Photo No. 2—The hand-powered machine followed the home-made one in the late 20's.

Photo No. 3—Next came the unit on which the paint supply and compressor were mounted on a truck. A seat for the operator was arranged on the bumper of the truck and the unit was propelled by a push bar from the truck united. Used in early 30's.

Photo No. 4—Next came the chassis which provided a seat for the operator and was constructed with a longer wheel base, which only painted a single 4-inch line. On this unit also paint supply and air compressor were mounted on the truck propelling the unit. This was used until recently.

Photo No. 5—The most recent improvement, which was constructed by Shop 4, District IV, is designed to lay the three-stripe centerline on pavements in one operation. The two 3-inch white lines and one 3-ineh black line are laid all at one time, thereby saving considerable time in doubling back over the section to paint the adjacent lines, as well as caring for the drying of the three lines at one time instead of in two or three operations as formerly.

The paint and air controls are mounted on the chassis of the striper which is propelled ahead of the truck by a push bar. The truck carries the paint supply in tanks, one for the black paint and two for white paint. The two white paint tanks are so hooked up that one may be filled while the other is being used.

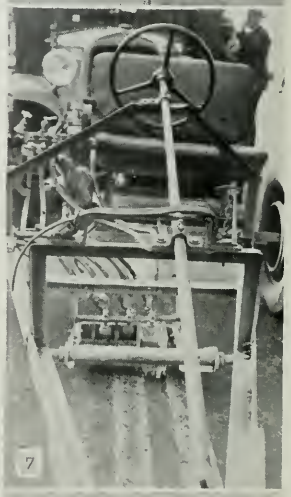
The truck also carries the air compressor unit and mixing tank equipped with an agitator where the paint is prepared for filling the supply tanks. The supply tanks are filled by pumping the paint from the mixing tank.

Photo No. 6—Shows front view of complete unit, 1937 traffic stripe marker used in District IV.

Photo No. 7—This is a close-up of spray box showing position of the three spray units on the stripe marker now being used.

Photo No. 8—Shows lines recently laid with 1937 model traffic stripe marker.


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Highway Bids and Awards for the Month of May

LOS ANGELES COUNTY—Carson St. between Lakewood Blvd. and Norwalk Rd., 4.0 miles to be graded and paved with Portland cement concrete and plant-mixed surfacing. District VII, Route 178, Section A.L.Bch. Dimmitt and Taylor, Los Angeles, $113,711; Matich Bros., Elsinore, $102,976; J. E. Haddock, Ltd., Pasadena, $111,575; Griffith Co., Los Angeles, $102,162; United Pipe Corp., Los Angeles, $117,347; C. O. Sparks and Mundo Engineering Co., Los Angeles, $119,739; Oswald Bros., Los Angeles, $98,617. Contract awarded to Sully-Miller Contracting Co., Long Beach, $96,909.00.

MONO COUNTY—At East Walker River, 6½ miles north of Bridgeport, timber and concrete bridge to be constructed and approaches graded thereto. District IX, Route 96, Section A. B. A. Hawkins and Co., San Francisco, $9,271; Vido Kovacevich, South Gate, $8,429; Young and Son Co., Ltd., Berkeley, $7,839; Rexroth and Rexroth, Bakersfield, $9,240; A. S. Vinnell Co., Los Angeles, $9,672; Isbell Construction Co., Reno, $8,230; Parish Bros, Los Angeles, $7,957; Contract awarded to Robert D. Paterson, Santa Barbara, $5,878.00.

SAN JOAQUIN COUNTY—An undergrade crossing under tracks of the A. T. & S. Fe Ry. at Wilson Way in Stockton, consisting of steel and concrete structure and 0.29 mile to be paved with Portland cement concrete and asphalt concrete. District X, Route 4, Section Stockton. Lord and Bishop, Sacramento, $219,832; Louis Biasotti and Son and John Rocco, Stockton, $267,084; O. H. Chain, Stockton, $245,100; Gates and Huntley, Los Angeles, $229,930; United Concrete Pipe Corp., Los Angeles, $216,734; F. O. Bohnett, San Jose, $220,598; Lindgren & Swinerton, Inc., Oakland, $225,650; Contract awarded to Earl W. Heple, San Jose, $212,364.50.

SAN LUIS OBISPO COUNTY—Between San Luis Obispo Creek and Cuesta Siding, 3.3 miles in length to be graded and surfaced with plant-mixed surfacing on crusher run base. District V, Ronte 2, Section D. United concrete Pipe Corporation, Los Angeles, $846,537; Granfield, Farrar and Carlin, San Francisco, $741,551; C. O. Sparks and Mundo Engineering Co., Los Angeles, $798,278; Griffith Company, Los Angeles, $798,881; Maeco Construction Co., Clearwater, $683,137; Guy F. Atkinson Company, San Francisco, $794,313; Utah Construction Co., San Francisco, $773,923; Basich Brothers, Torrance, $737,953; George Pollock Company, Sacramento, $666,633; J. E. Haddock, Ltd., Pasadena, $726,764; Bodenhamer Construction Co. and Lewis Construction Co., Oakland, $707,070; A. Teichert and Son, Inc., Sacramento, $708,235; Contract awarded to Metropolitan Construction Co., Los Angeles, $646,027.90.

SISKIYOU COUNTY — Between Cougar and Macdoel, 20.3 miles to be graded. (District II, Route 72, Section B) Union Paving Co., San Francisco, $310,229; Hemstreet and Bell, Marysville, $295,230; Clifford A. Dunn, Klamath Falls, Oregon, $225,608; Donald Atkinson, San Francisco, $274,710; A. Teichert & Son, Inc., Sacramento, $216,607; Geo. K. Thompson, Los Angeles, $286,598; Isbell Construction Co., Reno, $269,642; Morrison-Knudson Co., Inc., Los Angeles, $198,596; Harms Bros. and Larsen Bros., Sacramento, $197,216; Contract awarded to Harold Blake, Portland, Orgeon, $171,882.00.

TEHAMA COUNTY—A plate girder bridge with concrete deck across Sacramento River at Red Bluff. District II, Route 3, Section D. Andy Sordal and R. R. Bishop, Long Beach, $347,614; D. W. Thurston, Los Angeles, $346,887; Lord and Bishop, Sacramento, $279,214; Bodenhamer Construction Co., Oaklaud, $297,243; Guy F. Atkinson Company, San Francisco, $337,992; Pacific Bridge Co., San Francisco, $337,200; George Pollock Co., Sacramento, $309,694; Gates and Huntley, Los Angeles, $281,961. Contract awarded to J. F. Knapp, Oakland, $255,194.

VENTURA COUNTY—Between Pyle Road and Telegraph Road, 2.2 miles to be graded and surfaced with asphalt concrete and plant-mixed surfacing. District VII, Route 79, Section B,Fil.,C. Dimmitt & Taylor, Los Angeles, $91,372; Oswald Bros., Los Angeles, $97,440; United Concrete Pipe Corporation, Los Angeles, $92,684.



Picture shows how highway engineers built detour through orange grove and protected trees

Flood Compelled Detouring Through Fine Orange Grove

By E. T. SCOTT
District Maintenance Engineer

WHEN a river decides to change its course it has no respect for anything in its path. When a mild little creek like the Trabuco Creek in Orange County becomes a river it usually behaves as such, and during the storm of February 6–7 this little stream decided to change its course, cutting out over 300 lineal feet of an important State highway north of Capistrano to a depth of about 25 feet.

It not only washed away the State Highway but it cut into a beautiful orange grove, one of the few groves in Southern California to emerge from the cold spell of the winter with fruit that had not been damaged by the frost.

With the highway washed out and beyond immediate repair, and with the usual heavy traffic on this portion of U. S. Highway 101 eager to pass, the problem of detouring this great gap was made more difficult by the presence of the beautiful orange grove laden with a fine crop of fruit.

The only possible chance of detouring the washout was through the orange grove since all other roads for miles around had been rendered impassable by the heaviest storm to visit this part of Orange County in half a century.

The owner of the orange grove, Judge R. Y. Williams, was contacted and permission was received to permit light traffic to go through the orchard, provided same could be done without injury to the trees or the oranges.

Planks solved the detour surface problem but the beautiful fruit would have been very tempting if it could not be removed from the reach of passing motorists.

To protect the trees and hold the branches back from the roadway, a fence built of fine mesh chicken wire to a height of seven or eight feet was constructed parallel to the detour and it not only protected the trees from passing vehicles but prevented persons from picking the fruit.

Uniform Highway Signs

(Continued from page 10)

On a two or three lane road and for all but the center stripe for multiple lane roads, a four-inch white traffic lacquer stripe is used.

For the center of four-lane roads and for the crests of grades where less than 800-foot sight distance is obtained, a so called double line is used. This really is three lines of striping formed by two three-inch white lines separated by a three-inch black line.

TRANSITION STRIPE

The change from two to three, four or more lanes either increasing or decreasing the number is made by a standard transition stripe which guides traffic into the proper lanes for proceeding.

On obscured view crests of grade the double line is placed to give one lane up with a standard transition on the crest to permit two lanes down. The length of the double line is determined by adding four hundred feet to each end of the impaired sight distance. In advance of the one up double line, a dashed single line transition leads the motorist into the one lane up; because it is dashed, travel in the two lanes down may cross the transition line if the way ahead is clear.

The double white traffic line is being used to imply that it should never be crossed. Through this definite use the motorist will soon learn that the double line means just that. Wherever it becomes necessary because of intersections or turns for traffic to cross, the double line is either omitted or made a solid nine inch line.

CITIES COOPERATE

The above use of the double line is standard uniform practice on State highways. Those public ways over which the State does not have jurisdiction have been requested to cooperate in this standard use and with the exception of a few cities the uniform striping is used.

It is apparent that in order to obtain uniformity in traffic striping as well as in signs and signals, it is requisite that some central control be obtained and until the authority is given to such a control there will be no uniformity.

Safer Highways Make For Less Accidents

It will, of course, cost billions of dollars to give America even 100,000 miles of the high type of roadway, but that 100,000 miles might well carry 100,000,000 miles of traffic annually, and if that volume of traffic were carried on such highways, there would be a great reduction in the annual bill we are now paying for accidents. Leaving out any calculations for fatalities themselves, the total cost for property damage, doctors' bills, hospitalization, and lost time for 1936 was not less than $1,250,000,000. It looks to us as though America is paying for safe highways whether it has them or not.— *Michigan Roads and Construction.*

Many states have by legislative action seen the necessity in the interest of safety and the reduction of accidents to place such control in their Department of Public Works. The motorists soon learned upon entering a state whether such uniformity is obtained. It can readily be seen that when our traffic laws are uniform, when our signs, signals and markings are the same everywhere, the motorist will respond and our accidents will be reduced because of the ease of enforcement and the confidence given to the traveler.

REFLECTORIZED SIGNS

A recent form of marking is the use of reflectorized pavement markers placed on the center line. In order to keep the respect of this efficient but costly marking, these markers are placed only on curves which present a surprise to the motorist. When placed on a state highway the motorist knows that he should slow down because of the sharpness or unusual physical character of the curve he is approaching.

New Highway to Bay Bridge Will Be Ready July 1

To facilitate travel to the Golden Gate Bridge Fiesta, State Highway Engineer C. H. Purcell on May 26 opened the East Shore Highway, which forms a direct approach to the San Francisco-Oakland Bay Bridge from Richmond, El Cerrito, and Berkeley.

Informal ceremonies, in which the Richmond Junior Chamber of Commerce, the Berkeley Junior Chamber, and the Oakland Junior Chamber participated, were held at the junction of the road with San Pablo Avenue, near El Cerrito.

Harry A. Hopkins, Chairman of the Highway Commission cut the ribbon which opened this most recent Bay Bridge approach. Others participating were: Mayor of Berkeley E. E. Ament; Frank Tiller, Mayor of Richmond; State Highway Engineer C. H. Purcell; Colonel John H. Skeggs, District Highway Engineer; and J. N. Long, member of the Board of Supervisors of Contra Costa County.

Only two lanes of the four-lane highway were opened at the time and then closed. The final concrete paving will be completed before July 1. The project will cost approximately $1,020,000 (including the 1452-foot concrete El Cerrito Overpass). The section opened is 4.14 miles long. It has a 10-foot dividing strip down the center. When completed, it will be one of the most modern and finest stretches of highways in California.

Bridge Accidents Less

Accidents on the San Francisco-Oakland Bay Bridge were reduced 40 per cent in May according to the monthly report of Roadside Service and Accidents made by Chief Engineer C. H. Purcell.

There was a total of 9 accidents on both the bridge and approaches during the 31 days of May as compared to 15 for April. A reduction in drunk drivers and speeders over the bridge was also announced.

The total number of accidents since the bridge opened was brought to 74, with the number of persons injured totaling 75, out of an approximate estimate of 10,000,000 patrons.

Free Parking for Motorists on Bay Bridge

MOTORISTS using the San Francisco-Oakland Bay Bridge are entitled to free 24-hour parking in a paved and fenced area situated beneath the main approach on the San Francisco side.

The area lies between Third and Fourth streets and also includes a section just west of Fourth Street.

Motorists are advised that the most convenient way of reaching the area is from the Fifth Street Plaza, driving right to Harrison Street and then right again to Perry Street. The parking place lies longitudinally between Perry and Stillman streets.

Motorists leaving the parking area should drive via Bryant Street over Third or Fourth Street, and thence onto the Fifth Street Plaza and over the bridge.

This parking area leaves the motorist within only a few short blocks of the business district, with Third and Fourth Street streetcars available.

Motorists desiring to use the parking area will be given a ticket by the toll collector on the Oakland side, which will be surrendered to the attendant at the parking site.

Bay Bridge Ranks Third in Country in Traffic Carried

THE five millionth vehicle crossed the San Francisco-Oakland Bay Bridge May 31, bringing the actual total number of vehicles crossing the great span to 5,007,027 in the six and a half months of its operation, according to Earl Lee Kelly, State Director of Public Works.

The bay bridge ranks third in the United States in amount of traffic for a toll crossing. This was revealed by Chief Engineer C. H. Purcell, State Highway Engineer, in a report on six months' operation of the giant 8¼ mile structure.

According to traffic figures for March, gleaned from the leading toll crossings, the Bay Bridge is exceeded only by the Holland Tunnel of New York and the Delaware River Bridge at Philadelphia.

Traffic for the month of May topped all records for previous months by approximately 130,000 vehicles, with a total of 896,027 vehicles for May as compared with 766,790 for April, heaviest to that time, he announced from figures contained in the monthly traffic report on the Bay Bridge submitted by Chief Engineer Purcell.

The last four days of the month, including two holidays and featuring also the opening of the Golden Gate Bridge, brought 166,692 vehicles across the Bay Bridge.

Among the factors attributed by Mr. Kelly to May's large traffic were the normal seasonal rise and the 31-day month.

Traffic for May averaged 28,904 vehicles a day, an increase by approximately 3000 per day over April's daily average making May the banner month for patronage since the bridge opened. Average toll per vehicle was .5237 cents, with the month's total income amounting to $469,240.05.

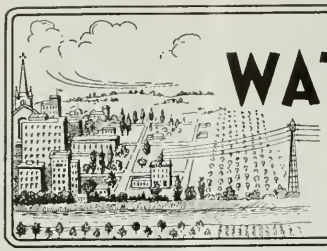
Other notable features of May traffic over the Bay Bridge, Mr. Kelly pointed out, were the increase in auto trailers and motorcycles by a third over April figures. Number of trailers for May was 1584; number of motorcycles, 3334.

The number of buses crossing in May was doubled over the preceding month, with a total of 8585 as compared to 4559.

Trucks and freight pounds show a slight but consistent increase, with 56,808,330 freight pounds for May, bringing the total to date to 289,721,682. Trucks numbered 24,981, in comparison to April's total of 24,737.



Spacious parking space under San Francisco Bay Bridge free for 24-hour period to patrons of the span.



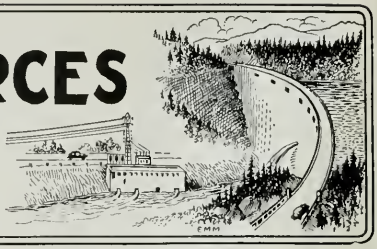
DIVISION OF WATER RESOURCES

OFFICIAL REPORT

FOR THE MONTH OF

May, 1937

EDWARD HYATT, State Engineer



IRRIGATION DISTRICTS

The petition for a new district, to be known as Shafter-Wasco Irrigation District, was approved as to sufficiency by the Kern County Board of Supervisors on May 10th, and submitted to the State Engineer for investigation and report as to feasibility. The proposed district embraces an area of about 40,000 acres northwest of Bakersfield.

A report was made on the proposal of Richvale Irrigation District to issue bonds in the amount of $90,000 for acquiring additional water rights and irrigation facilities from the Sutter Butte Canal Company. The district was recently enlarged by inclusion of the Maxwell Tract containing about 3155 acres.

Carmichael Irrigation District completed plans for refunding an outstanding bond issue in the amount of $79,600 through a loan of $53,000 from the Reconstruction Finance Corporation, augmented by district funds.

Districts Securities Commission

At meeting of the Commission held in Los Angeles on May 14th the following district matters were given favorable consideration:

The plan of readjustment of indebtedness of El Dorado Irrigation District was approved and consent was given to the filing of a petition in the superior court, pursuant to provisions of the new Irrigation District Refinancing Act.

The proposal of Tulare Irrigation District to expend $58,750 for purchase of additional shares of capital stock in the Wutchumna Water Company was approved.

Refunding bonds of Alpaugh and of Beaumont Irrigation districts, in the amounts of $101,000 and $159,000 respectively, were validated for certification by the State Controller.

Plans of Imperial Irrigation District for development of power on the All-American Canal were approved. The district will enter into contracts with the Federal Government, and issue revenue bonds to PWA and REA for funds with which to construct power plants and distribution facilities in Imperial Valley.

FLOOD CONTROL AND RECLAMATION

Relief Labor Work

During this period an average of 75 men on WPA Project No. 6805 (formerly No. 5416) were engaged in clearing the Feather River channel north of Marysville. SRA Transient Camp No. 7, in the Sutter Basin, furnished an average of 25 men. These men were engaged in cleaning up the grounds round pumping plant No. 3 and also in installing a tile drain system at the Sutter maintenance yard.

WPA Project No. 6654, in Yolo County, furnished an average of 33 men during the period. They have been engaged in clearing brush and timber in the Sacramento By-pass.

SUPERVISION OF DAMS

Application was received on April 23, 1937, for the alteration of the Huntington Lake Dam No. 1 of the Southern California Edison Company situated on Big Creek in Fresno County. The work contemplated is the construction of an auxiliary spillway and the placing of fill on the downstream face of the dam. This work was approved on May 4, 1937.

Application was filed on April 22, 1937, by the Pacific Gas and Electric Company for alterations at Lake Arthur dam located on Dry Creek tributary to the Yuba River in Placer County. The work comprises reconstruction of the crest to provide a greater spillway capacity. This application was approved on May 3, 1937.

Application was filed on April 22, 1937, by the Pacific Gas and Electric Company for the alteration of the Lake Theodore Dam situated on South Fork of Dry Creek tributary to Yuba River in Placer County. The work proposes the reconstruction of the spillway chute. This application was approved on May 3, 1937.

WATER RIGHTS

Supervision of Appropriation of Water

Twenty-six applications to appropriate water were received during April, five were denied and twelve were approved. In the same period seven permits were revoked and the rights under eleven permits were confirmed by the issuance of license.

Inspections of projects covered by permits of the Division are being made during the current month in Santa Cruz, Santa Clara and Stanislaus counties and other coastal and adjacent counties northward to Del Norte and Siskiyou counties.

SACRAMENTO-SAN JOAQUIN WATER SUPERVISION

During the past month the activities have been both in the field and office. The field work has consisted of visiting all points of diversion and acquainting the operators with the record keeping procedure. Measurements are being made of the few plants which are actively operating. The pumping has not been very heavy to date on account of the abundance of rainfall.

The Sacramento River at Sacramento has remained fairly high during the past month and the flow on May 24th was 35,000 cubic feet per second. The melting snows have caused a rise in the San Joaquin Valley east side streams and the flow of the San Joaquin River at Lathrop into the delta on May 24th was 18,500 cubic feet per second.

CALIFORNIA COOPERATIVE SNOW SURVEYS

During the first week of May the final scheduled snow surveys for this year were made at all key snow courses. These snow surveys were made for the purpose of determining the amount of snow melting that had taken place in the mountains during the preceding month and to serve as a check on the previously published estimates of stream flow forecast early in April.

WATER RESOURCES

San Luis Rey River, San Diego County

The report on the investigation and survey of San Luis Rey River in San Diego County for the purpose of securing data and preparing plans for flood control, rectification of river channel and conservation and utilization of the waters of the San Luis Rey River was completed by the Division of Water Resources and released during the present month.

CENTRAL VALLEY PROJECT

The United States Bureau of Reclamation continued work during the month on the preparation of plans necessary for starting construction on the initial units of the project. Preliminary investigations and exploration work have been continued at Kennett and Friant dam sites as have the surveys along the Contra Costa conduit and Friant-Kern canal. Appraisers are working in the field evaluating lands and necessary rights of way to be acquired. The Division of Water Resources has continued surveys and investigations in the San Joaquin and Sacramento Valleys preliminary to acquisition of properties and water rights.

Photo Electric Recorders Make Count of Highway Traffic

(Continued from page 6)

the characteristics of the metropolitan area of Los Angeles.

Two counters have been assigned to record traffic that is definitely known to be recreational in character. One is on Route 42 west of its junction with Route 55, the Skyline Boulevard. This records traffic into the Big Basin, Boulder Creek, and Redwood Park. The second is located on the famous Arrowhead Springs Road, Route 43 at the Panorama Point Maintenance Station.

INTERESTING VARIATIONS

Some interesting variations have been observed in the records turned in by these installations. The highest 24-hour count recorded to date was on the counter at Whitewater, Easter Sunday, with a total of 15,862 vehicles. This represented 33% of the total traffic for that week, whereas the average Sunday traffic at Whitewater is only 25% of the week's total.

The counter at Panorama Point, on the other hand, dropped to its lowest Sunday count on Easter Sunday, a total of 2,265 vehicles. This was 33% of the week's total travel, the same as at Whitewater. However, the average Sunday traffic at Panorama Point is 54% of the week's total—more than twice as high a percentage as at Whitewater in the valley below it. Thus we find what a great difference exists in the traffic pattern of recreational and primary through routes even in the same area.

Practically all records agree in one characteristic. The traffic curve between midnight and daylight is nearly a straight line, with the same number of vehicles passing each hour. With the coming of summer the curve starts to rise at an earlier hour, and the total for the day increases but the total traffic at each location during the hours from midnight to daylight does not increase correspondingly.

The light source and receiving units are placed with a skew angle of 23° across the center line of the road. This does not entirely eliminate the recording of a truck and trailer as two vehicles. On the other hand a certain percentage of cars pass each other at the recorder and therefore record as only one vehicle instead of two. In some installations these two errors very nearly balance out. At the counter located at the San Joaquin River bridge on Route 4, the preponderance of heavy truck and trailer traffic during the night hours makes the count higher than it actually should be, whereas the day count due to cars passing each other often goes under actual.

In the Santa Ana Canyon, the counter sometimes records two or more vehicles for one passing automobile due to the fact that cars approaching the curve on which it is located, at high speed, cut in on the shoulder which is lower than the center of the road, permitting the beams to pass through the glass of the car instead of being continuously interrupted by the body.

"PHANTOM" TRUCKS

Most of the installations are so placed as to give a northern exposure to the receiving unit in order to minimize the effect of stray light. In some instances this has resulted in "phantom" trucks passing the recorder without counting. This phenomenon is accounted for by the fact that the flat sides of a truck painted white or aluminum color will, at certain hours of the day in Spring or Fall, reflect enough light back in to the receiving unit to replace the light ordinarily furnished by the light source. This holds the relay down and does not permit the counter to operate.

The recorders count instantaneously and will clock cars as fast as they pass and as close together as they can run. It has been found advisable, however, to place them only on two-lane highways.

In spite of the occasional errors due to double counting, or failure to count the second car when two cars are passing at the same time, cursory inspection of the records of the machines indicates that the total of the errors is insignificant.

Father: "Isn't it wonderful how little chicks get out of their shells?"

Son: "What gets me is how they get in."

C. H. Purcell Is Named Member of U. S. Road Group

Twelve nationally known experts in highway engineering, including State Highway Engineer C. H. Purcell of California, have been appointed by Secretary of Agriculture Wallace to work with the U. S. Bureau of Public Roads in developing standards of highway design to promote maximum safety and highway utility.

The work to be done has the full support of the American Association of State Highway Officials, which through its Executive Committee recently stressed the urgent need of reviewing administrative policies concerning minimum standards for the design of roads.

Meetings of the experts with Bureau of Public Roads officials will be held from time to time to consider matters such as road surface widths, maximum grades and curves, design of multi-lane highways, protection of grade crossings and many other problems.

Thomas H. MacDonald, Chief of the Bureau of Public Roads, will act as chairman of the committee of 12 who are:

C. H. Purcell, State Highway Engineeer, Sacramento, California. Ernst Lieberman, Chief Highway Engineer, State Department of Public Works and Buildings, Springfield, Illinois. Fred Kellan, Design Engineer, State Highway Commission, Indianapolis, Indiana. Hugh Barnes, Chief of Highway Planning, State Highway Commission, Topeka, Kansas. G. H. Delano, Chief Engineer, State Department of Public Works, Boston, Masachusetts. O. L. Kipp, Construction Engineer, State Department of Highways, St. Paul, Minnesota. Murray D. Van Wagoner, State Highway Commissioner, Lansing, Michigan. Harold W. Giffin, Engineer of Surveys and Plans, State Highway Department, Trenton, New Jersey. R. H. Baldock, State Highway Engineer, Salem, Oregon. P. M. Tebbs, Assistant Chief Engineer, State Department of Highways, Harrisburg, Pennsylvania. Gibb Gilchrist, State Highway Engineer, Austin, Texas. C. S. Mullen, Chief Engineer, State Department of Highways, Richmond, Virginia.

Cost of Highway Construction Cut By New Methods

(Continued from page 14)

ous locations over old fills, considerable settlement took place during this operation.

EXPERIMENT ORDERED

It was therefore assumed that a thorough job of pounding might accomplish satisfactory consolidation without removal and recompaction over shallow fills, and might be used in conjunction with removal and recompaction of a more shallow trench construction through the deeper fills.

Between Station 386+00 and Station 387+50, the portable crane and ball operated over an area of 154 square feet per hour at a cost of $8.79, equal to 5.7 cents per square foot, and was able to break up the old pavement and drive it into the old fill and lower the grade of the entire area by one foot.

To subexcavate and backfill in order to recompact this area would have required complete removal and disposal of the existing pavement, at an estimated cost of about $76. At the contract price of 30 cents per cubic yard for roadway excavation, the removal and recompacting cost per square foot was 2.22 cents per foot depth of fill reconsolidated. The depth of fill reconsolidation by excavation and backfill methods equivalent to the crane and ball method, therefore, was but 2.56 feet, and since a satisfactory job could not be obtained without recompacting double this depth, it is evident that this method deserves further consideration.

Relative compaction tests taken before and after tamping show very favorable results, increases being as follows: Directly underlying the existing pavement, compactions increased from 89.1% to 92.9%, and at a depth of 5 feet, the increase was from 82.1% to 91.8%. The soil was a mixture of black adobe and brown clay, with a moisture content far above the optimum value, running 28% to 33%, and therefore accounts for the relatively low increase at the surface, the value of 92.9% being about the maximum compaction attainable under such high moisture content.

In Memoriam

GEORGE McIVOR

The State of California lost a valuable citizen, the Department of Public Works a faithful employee and co-workers a staunch friend, when death suddenly overtook George McIvor of District X of the Division of Highways May 2, 1937.

Born October 17, 1892, McIvor was educated in Tuolumne County, and spent a great portion of his life there. Early in his career he was employed by large lumber companies and the Sierra Railway Company in the Mother Lode. On May 16, 1928, he joined District X of the Division of Highways as a sub-foreman and on September 1, 1933, was promoted to the position of superintendent with headquarters at Bishop in District IX.

At McIvor's request he was transferred to District X on December 1, 1935, to serve as superintendent of construction projects in connection with maintenance improvement activities.

While it was known that McIvor had not been in the best of health while on duty in District IX, after his return to the Mother Lode country his condition was so much improved that his sudden passing was a shock and sorrowful surprise to his many friends.

On May 2 McIvor was driving to his new assignment, with his nephew following in a second car. At a point a few miles north of Jackson, McIvor's car suddenly left the road, crashed into a cut bank and turned over. He passed away while being rushed to a Jackson hospital. The coroner's inquest attributed his death to heart failure. Interment was at Tuolumne.

HEAVY PRESSURE DEVELOPED

A pressure cell placed 5 feet under ground was carefully backfilled and compacted by dropping the 2500 pound ball a height of 18 feet, and a pressure gauge placed at the ground surface registered a maximum reading of 16 pounds per square inch. Adding to this value 2.3 pounds per square inch due to the 5-foot column of water between the cell and the gauge, the pressure developed at the cell would be 18.3 pounds per square inch. The dead load of 5 feet of compacted earth would equal about 5 pounds per square inch at the depth of the pressure cell, so it is evident that a pressure of 1900 pounds per square foot was being exerted by the compression in the soil. Since about a 10 pound fluctuation of the needle was visible at the instant the ball struck the ground, it is evident that at this depth there was an additional active force of 1440 pounds being exerted toward compacting the soil.

Harry A. Hopkins Resumes Post As Highway Chairman

IN RECOGNITION of his past service as a member of the California Highway Commission and in response to many requests from different parts of the State, Harry A. Hopkins, who resigned as chairman of the Commission to run for Congress in the Tenth District, was reappointed head of California's road building agency by Governor Frank F. Merriam on May 20. Mr. Hopkins was defeated at the May 4 special election held to select a successor to the late Congressman Henry E. Stubbs.

Mr. Hopkins, pioneer resident and civic leader in Kern County, was appointed a member of the Highway Commission in January, 1931, by the late Governor James Rolph, Jr., and in 1932 was elevated to the post of chairman, a position he held up to his resignation last spring.

Chairman Hopkins was sworn in by Judge Harry W. Beatty of Taft on the afternoon of May 20. Present at the ceremony as witnesses were Mrs. Harry Hopkins, Mrs. Elmo Fullmer, daughter of Mr. and Mrs. Hopkins; Miss Theda Fleming, secretary to the chairman; W. H. Fitzgerald, Herb Arndt, secretary of the Taft Chamber of Commerce; Abe Marks, Lee Coker, R. F. Casey and Miss Alma Wilson, Judge Beatty's secretary.

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Department of Public Works

Headquarters: Public Works Building, Eleventh and P Streets, Sacramento

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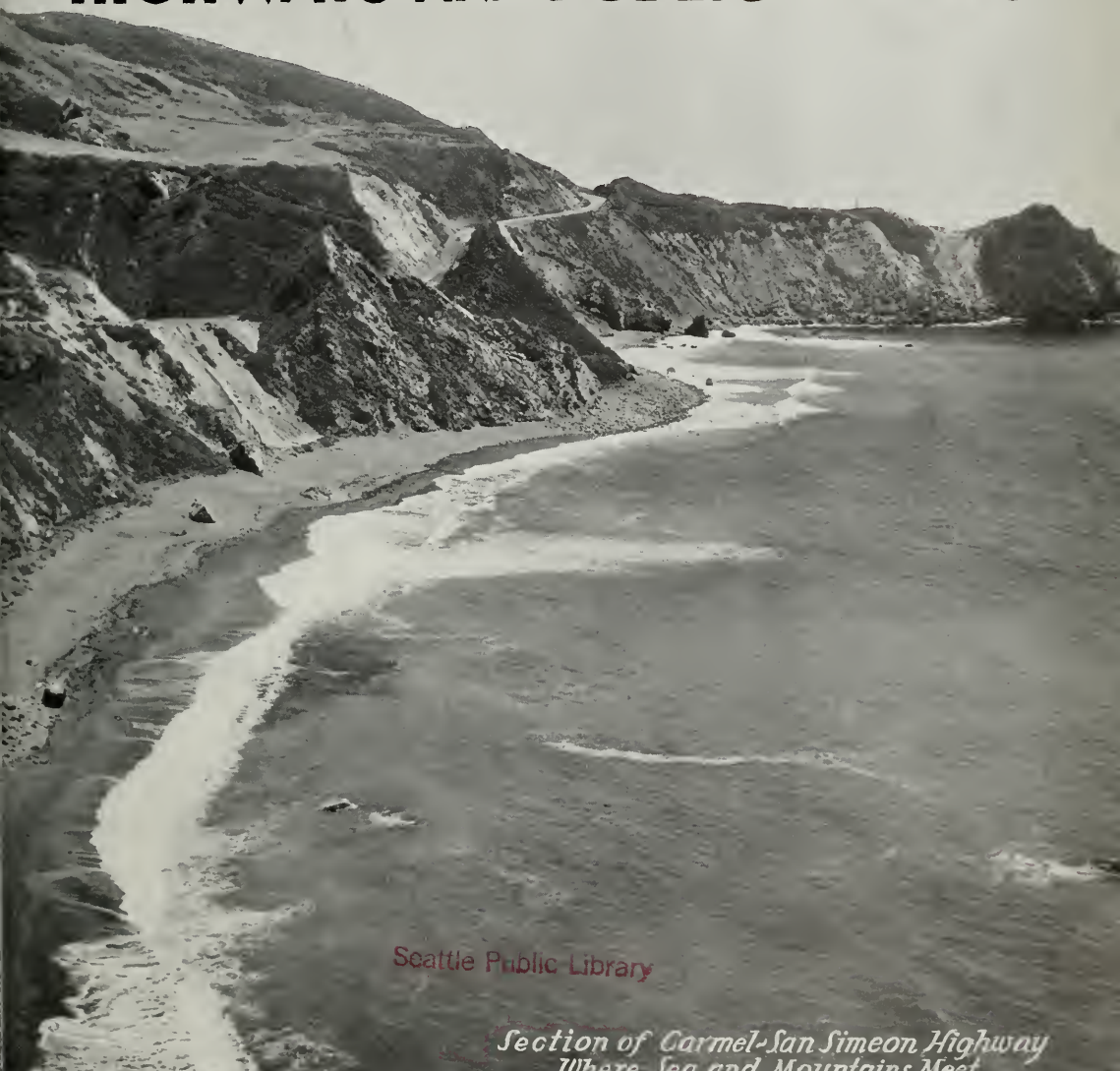
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Official Journal of the Department of Public Works

JULY · 1937

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways of the Department of Public Works, State of California

EARL LEE KELLY, Director | C. H. PURCELL, State Highway Engineer | JOHN W. HOWE, Editor

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Scene at Pfeiffer Park in Big Sur where Governor Merriam set off dynamite blast to remove large boulder shown in center foreground, thus officially opening Carmel-San Simeon Highway while costumed characters of the past looked on.

A Dream Comes True

By LESTER H. GIBSON, District Highway Engineer

A COLORFUL pageant in which costumed actors depicted the history of the Big Sur country from the period when it was the bed of the Pacific Ocean and through the years of the California aborigines, the Franciscan padres, the Spanish and Mexican conquests, the coming of the British and the pioneers of early days preceding American occupation and leading up to the road builders of the State Division of Highways marked the final dedication of the nine million dollar Carmel-San Simeon Highway at Pfeiffer Park in Monterey County on Sunday, June 27.

Lighting a fuse to a dynamite charge that blasted a huge boulder, symbolical barrier of the new State Highway, Governor Frank F. Merriam officially opened the completed road to traffic. State Director of Public Works Earl Lee Kelly and the Governor then operated a bull-dozer which removed the huge rock from the road and a dream of 40 years came true.

GOVERNOR DEDICATES MONUMENT

The occasion also was the dedication of the Pfeiffer redwood grove and surrounding acres as a State Park. Ceremonies concluded with a barbecue at which talks were made by the Governor, Mr. Kelly, Harry A. Hopkins, chairman of the California Highway Commission; Joseph R. Knowland, president of the California Park Commission; Arthur E. Henning, Chief of the Division of Parks, Dr. John L. D. Roberts, who conceived the idea of the new highway more than four decades ago; Colonel Troop Miller, commandant of the Monterey Presidio; State Senator Edward H. Tickle, Mayor Emmet McMenamin of Monterey and other State, county and civic officials.

Previously, Governor Merriam had dedicated the highway in San Luis Obispo County and a monument at Cambria to the late State Senator Elmer S. Rigdon who fathered legislation twenty years ago appropriating funds to start the highway.

The opening of the Carmel-San Simeon link of the Roosevelt Highway on June 27th, between Carmel and San Simeon brought to a successful culmination the dream of many far-sighted men who, in spite of opposition and lethargy, have carried through the fight to open up to the people of California and of the entire United States this section of coast country which is outstanding in its beauty and scenic grandeur. While we can not give credit to all those who were instrumental in bringing this achievement through to a reality, there are two men who are being credited with the early pioneering work, who should be mentitoned in any story having to do with the history of this development.

One of these, Dr. John L. D. Roberts, a young practicing physician of Monterey, at the time, was impressed with the beauty of this coast country during his trips afoot or horseback to attend the families of the early settlers. As early as 1897 this young doctor made a five day trip on foot through the rugged western slope of the Santa Lucia mountains. He obtained data and pictures which twenty years later, in 1917, through the instigation of Senator Elmer S. Rigdon, were presented to the State Legislature with the result that the legislature provided an appropriation for making surveys and engineering studies for this highway, together with other additional California State highways.

HONOR SENATOR RIGDON

What a thrill it must have been to "Doc" Roberts when, at the dedica-

tion of the Carmel-San Simeon Highway, he saw Governor Merriam formally open this scenic road to the people of the State of California, and brought to a successful conclusion his dream and efforts covering a 40 year period or more.

While "Doc" Roberts has been spared to actually see the dedication of this road, the other outstanding pioneer, Senator Elmer S. Rigdon, passed away in 1922 just after construction was started. His memory was honored on June 27th by dedication of a memorial plaque at a little park on the highway. The tablet to his memory has been set upon a large rugged stone symbolic of the strength and courage of this pioneering legislator. The untiring efforts of the Senator in obtaining recognition from the State Legislature were as essential to putting this road through to its present completion, as was the vision and zeal of "Doc" Roberts, for neither of these men could have accomplished their entire purpose alone.

FUNDS MADE AVAILABLE

Following the initial appropriation for surveys, the voters of California in July, 1919, ratified a Constitutional Amendment providing for the Third Highway Bond Issue of $40,000,000 which required that the Carmel-San Simeon Highway should be included in the State Highway System and a portion of the bond issue be used for its construction. Subsequent appropriations were made from monies available to the Highway Commission for construction purposes, bringing the total of such authorizations to an amount slightly less than $9,000,000.

At the time of the first appropriation covering surveys for the road, there were only very limited means of ingress to this precipitous country. There was a narrow, winding, steep road from Carmel south for a distance of approximately 35 miles to the Big Sur River. From that point south to San Simeon, it could only be traveled by horseback or on foot. There only exisited the narrow trail, known as the Coast Trail, over which all supplies for the survey crews, as well as the early pioneering settlers, had to be carried on mule or horseback from the nearest shipping or supply point.

The terrain through which this road passes is, generally, a rocky, precipitous country, rising from the ocean to a height of several thousand feet. Interspersed are occasional flats broken by many deep, steep canyons in which there are beautiful growths of redwood and other trees and shrubbery indigenous to this particular section of the country.

SURVEYS AND ENGINEERING STUDIES

Following the appropriation for surveys previously mentioned, a stadia reconnaissance survey was made and completed in 1918, which, while not too closely followed in the final location, formed a basis for the ultimate location and construction. In many places the located line deviated considerably from this early survey, taking advantage of a lower plane which offered a better line and grade and a shorter length.

In October of 1919 a location survey party started to work from Anderson Canyon toward Big Sur, which points are approximately 50 and 35 miles south of Monterey. In February of the following year another location survey was started working northerly from San Simeon. From that time on, location surveys

(Continued on page 14)



Members of Governor's official party at ceremonies attending dedication of monument to late Senator Elmer S. Rigdon, whose legislative labors helped make Carmel-San Simeon Highway possible. Seated, left to right—Ray W. Shamel, president Cambria Chamber of Commerce; Julien D. Roussel, Secretary, California Highway Commission; Governor Frank F. Merriam, Director of Public Works Earl Lee Kelly, Earl S. Anderson, Registrar of Contractors; Edward J. Neron, Deputy Director of Public Works. Standing—Justus F. Craemer, Assistant Director of Public Works, Highway Commissioner H. R. Judah.



Portion of auto caravan at Carmel-San Simeon Highway dedication.







Governor Merriam places wreath on monument to late Senator Elmer S. Rigdon, early advocate of highway. Left to right: Miss Barbara Edmonson, San Luis Obispo "Outdoor Girl"; Mrs. Elmer S. Rigdon, Miss Joyce Matheson, "Miss Cambria Pines"; Governor Merriam.



Upper—view of section of new highway. Lower—Governor Merriam and Director of Public Works Earl Lee Kelly operate bull-dozer to remove last boulder barricade from new highway. Standing beside them is District Highway Engineer Lester H. Gibson, who supervised building of road.

State Builds 29 Bridges On Carmel-San Simeon Highway

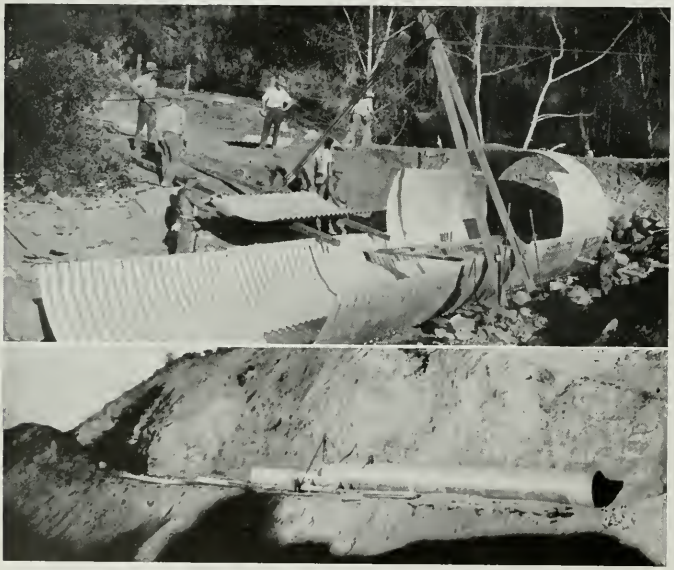
IN BUILDING the Carmel-San Simeon Highway, the design and construction of several of the 29 bridges now in place presented difficult engineering problems. The largest of these structures is the beautiful reinforced concrete open spandrel arch across the mouth of Bixby Creek, 18 miles south of Carmel.

Placing a bridge across the deep gorge where Bixby Creek empties into the ocean was difficult. The concrete abutments, securely anchored into the sheer rock walls 140 feet above the creek bed, are 330 feet apart and the graceful rings of the open spandrel arch bow above the canyon mouth to carry the deck of the bridge approximately 260 feet above the creek bottom. The total length of the bridge deck is 714 feet, there being three 40-foot reinforced concrete approach spans on the southerly end and six on the northerly end. In the construction of this spectacular arch 6,600 cubic yards of concrete and 600,000 pounds of reinforcing steel were used.

The bridge is so placed that the curving highway approaches afford an excellent view of the structure. The Bixby Creek bridge is the largest concrete arched highway structure in the western states.

BEAUTIFUL STRUCTURES

About one mile north of the Bixby Creek bridge a similar, but smaller, open spandrel arch was constructed across the mouth of Rocky Creek. This graceful structure has an arch span of 239 feet and the 497 feet of total deck length carry the roadway 150 feet above the creek. Similar reinforced concrete arches of shorter spans were built across Granite, Garrapata and Mal Paso creeks and a sixth arch bridge consisting of three short arch spans crosses Wildcat Creek about five miles south of Carmel.



Upper photo shows size of multi-plate culvert used in constructon of Carmel-San Simeon Highway. Lower—Long length of multi-plate culvert used 45 miles north of San Simeon on new road.

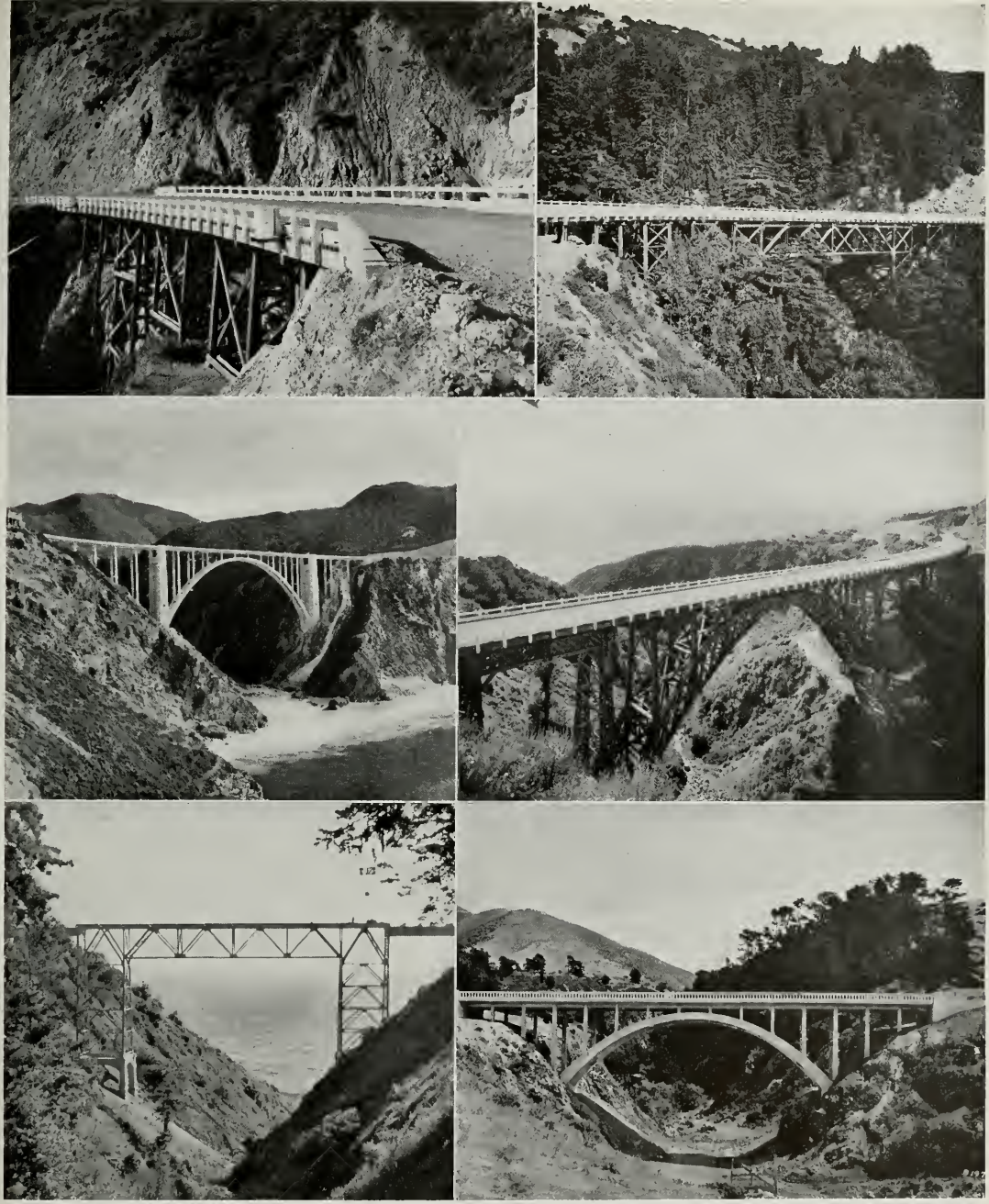
Another bridge of interest, to be built as a unit of the Carmel-San Simeon project, is the 514-foot structure across Dolan Creek with its 180-foot three hinged timber arch span in the center. The depth and width of the Dolan Creek gorge dictated a structure with a long central span and to eliminate long haul of concrete aggregates from Monterey, a timber structure, using the recently developed metal ring connectors for joints, was selected. Built of redwood, the Dolan Creek timber arch is an impressive structure as it carries the roadway 150 feet above the creek bed.

MODERN TOURIST HIGHWAY

Most of the bridges on this scenic ocean highway, such as those across Lime, Prewitt and Wildcattle creeks and Torre Canyon are of the usual timber construction, while others, like the Burns Creek, San Simeon, Pico and Little Pico creeks are of steel.

Completion of the Carmel-San Simeon route opens to the California tourist a modern highway which is replete with the incomparable views obtainable only at those rare locations where the mountains meet the sea. The majesty of rocky promontories with colorful surf breaking at their bases will leave memories never to be forgotten of the natural grandeur of this section of California. Such points as the Point Lobos State Park, picturesque Carmel Highlands, Point Sur with its famous lighthouse and the palatial Hearst estate at San Simeon will all add to the pleasureable interest of the trip along this new State highway.

The work on the 93 miles between Carmel and San Simeon has presented one of the most noteworthy pieces of highway engineering accomplished on the west coast in recent years and has given to the traveling public a modern ocean shore highway of unparalleled beauty with superb views of the Pacific from elevations ranging from sea level to that of Grimes Point at elevation 1058.



Pictorial story of the bridges of the Carmel-San Simeon Highway. Six of the twenty-nine completed structures on the scenic route. Upper left—Lime Creek Bridge. Upper right—Torre Creek Bridge. Center left—Bixby Arch. Center right—Dolan Creek structure. Lower left—Bridge over Burns Creek. Lower right—Mal Paso Bridge.

State Constructing New Road Leading Into Death Valley

This is a story of the building of a desert road; the story of a road through fantastical formations to romantic Death Valley; the story of a road to connect the deepest portion of these United States to the highest peak within our country; the story of the Darwin Cut-Off, the building of which may best be told by the men who directed the stages of its growth.

S. W. Lowden, Acting District Engineer.

RECONNAISSANCE

By J. N. STANLEY, Associate Highway Engineer

A MAP of the existing road from Lone Pine, in the Owens Valley, to Stovepipe Wells, in Death Valley, shows a great bend to the south, with the little settlement of Darwin at its southernmost apex.

It was conceived that distance could be saved if another route could be found, that would cut across this "dog leg," a route that would follow the ridges and be out of the path of cloudbursts, and with alignment that could be constructed economically, yet be an improvement over the existing tortuous grades of Zinc Hill, that nemesis of the tourist.

A narrow, dusty road, approximately 19.9 miles in length, with grades of from 15 to 20 per cent, and curves of 30-foot radius made another alignment imperative.

Each summer cloudbursts descended upon Darwin Wash, down which the old road wound its way, and each summer found the maintenance forces rebuilding a State highway which had been obliterated.

DIFFICULT RECONNAISSANCE

In 1934 heavy footgear was put in order, and a start was made upon a reconnaissance of that country lying north of Darwin. No roads exist in that jagged array of mountains, the few trails made by wild horses and burros led nowhere and horseback riding was out of the question due to the poor footing and lack of grazing and water. Headquarters was established at Darwin, and a Ford express

(Continued on page 27)

Survey and Plans

By MILTON HARRIS Associate Highway Engineer

NOVEMBER of 1935 found our location party in Darwin ready to undertake the task of running a line into Panamint Sink from a point approximately six miles west of that town.

Following the route of the reconnaissance survey of the year previous, centerline was rapidly staked for the first six miles, and the plans completed in our field office. To allow access to that portion of the project lying in proximity to the rim of canyons extending into Panamint Sink, a crude road was built for some eight miles to the head of what was later christened "Rainbow Canyon" by the party. From the head of this canyon, an old game trail was followed in reaching line. This trail skirted the very edge of this many-hued gorge, estimated to be over 800 feet in depth. Relics of early Indian habitation were discovered along this trail, and as a result of our daily hike that unfolded the colorful strata of the canyon walls, it was decided that at all costs we must locate the new highway so that travelers would enjoy this scenery.

ECONOMY IN CONSTRUCTION

Descending on a steady 6 per cent grade from the rim of the high plateau, we kept our line on the best possible ground, seeking for economy in construction at all times. We managed to swing to the brink of "Rainbow Canyon" after having circled its upper reaches, unfolding,

(Continued on page 27)

CONSTRUCTION

By A. C. BRINEY Associate Highway Engineer

ON DECEMBER 30, 1936, a contract was awarded the Peninsula Paving Company, and on January 12, 1937, the first equipment moved on the project. Operations were started at the westerly end with scraper equipment as the first 5.5 miles were through loose material, easily moved with this type of machinery. Freezing weather added an unexpected obstacle, however, as the loose material congealed to a depth of from 8 to 10 inches, necessitating the use of rooters. Even the desert experiences freezing temperatures, especially at a 5,000-foot elevation.

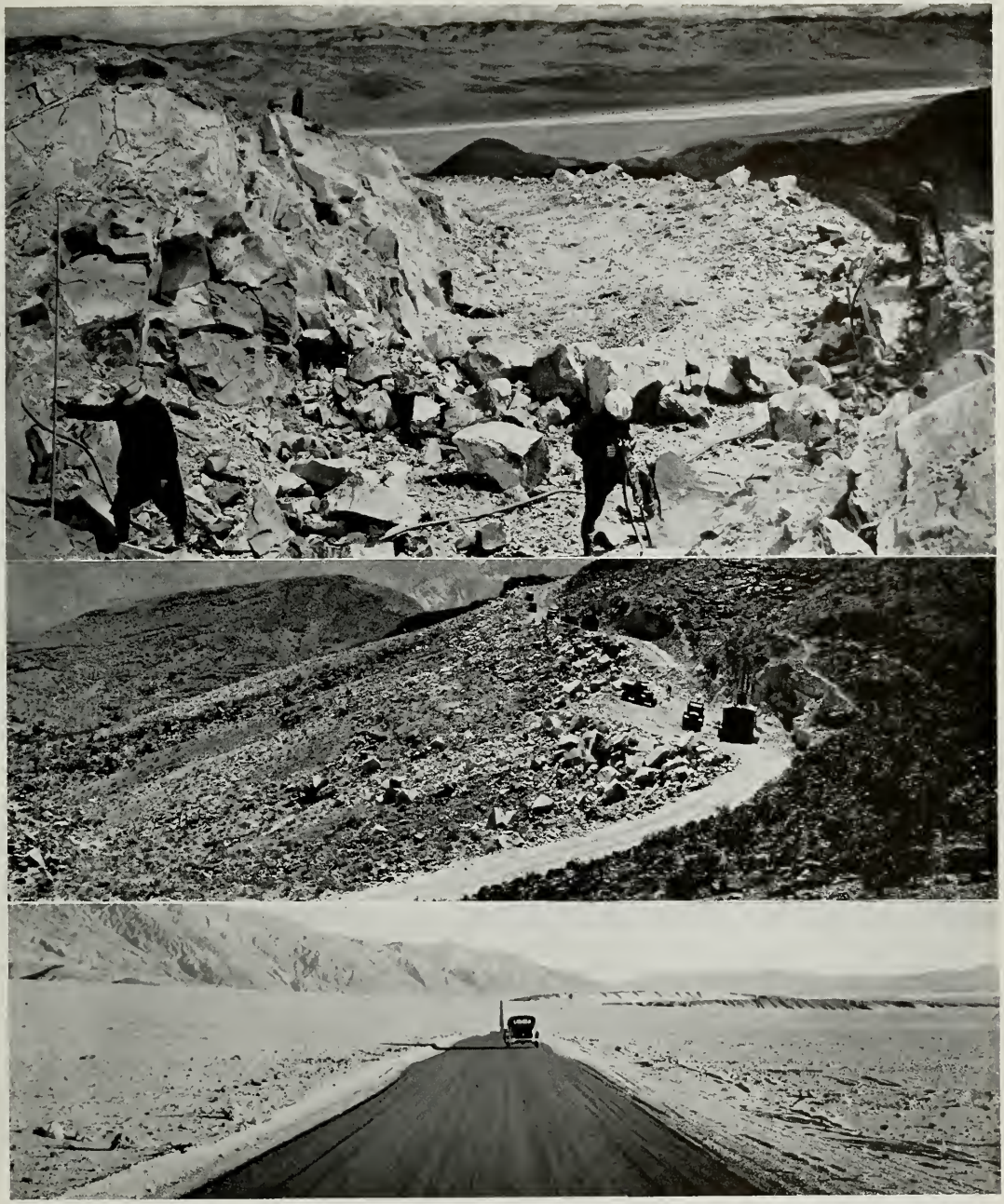
The next 5.3 miles developed material that was of a rocky, cemented nature, interspersed with ledges of solid rock. The latest type of tractor equipment pulled rooters through this material, and scrapers were able to move the major portion of the excavation into place. The rocky portions were loosened with powder and moved into the embankments with the aid of a power shovel and trucks.

THROUGH VOLCANIC DEPOSITS

The remaining 6.8 miles of the project are composed of rock in all stages of hardness, position and mixtures. Past movements of the earth's crust and volcanic action threw an intricate variety of problems into the hands of the contractor.

A hillside of large boulders piled one above the other, each boulder of a consistency that caused it to ring

(Continued on page 27)



Construction scenes on new highway leading into Death Valley and eliminating Darwin Wash. Drillers at work on difficult stretch with Panamint Sink and Panamint Mountains in distance. Heavy equipment at work on grade which will do away with steep, narrow roadbed over Zinc Hill and Lane Hill. Section of completed desert highway.

Extensive Highway Planning Survey Undertaken By State

By K. A. MacLACHLAN, Assistant Maintenance Engineer

FOR the past year the Division of Highways has been conducting a state-wide highway planning survey in cooperation with the U. S. Bureau of Public Roads. These surveys are being made by forty states for the purpose of collecting data needed to coordinate future highway planning efforts.

On many parts of the present State Highway System which were constructed in the early stages and on parts which were inherited from the counties, the existing degree of improvement is vastly inadequate, made so largely by unpredictable changes in the design and degree of use of motor vehicles.

The nature of such changes, affecting principally the speed of vehicles, determines the character of the road's deficiency. These deficiencies lie to a great extent in grades, alignment and width. These three features are therefore made the subject of a limited feature survey which seeks to list and classify them to the end that their modification may be studied.

SELECTED ROUTES SURVEYED

In California this particular phase of the Highway Planning Survey has been confined to selected routes embracing 9,129 miles of State Highway, Federal Aid Highway, National Park, National Forest, and county roads. The limited features recorded were restricted horizontal and vertical sight distances; curvature, showing location, length and radii of curves; superelevation on curves; percentage and length of all grades of three per cent or more when 500 feet or more in length. In addition, notes were made of the length and type of traffic stripe, and the type of topography of sections traversed.

Much information was readily available on highway plans filed in the office of the Division of Highways. Alignment and grade data for 4,972 miles were transferred from these plans to field check sheets to facilitate the field work.

No plans were readily available on many of the inherited roads. It was therefore necessary to procure all of the required data on 4,157 miles, in the field. To expedite this work, special instruments were designed, constructed and installed in two light sedans. The design and use of these instruments are described here in some detail.

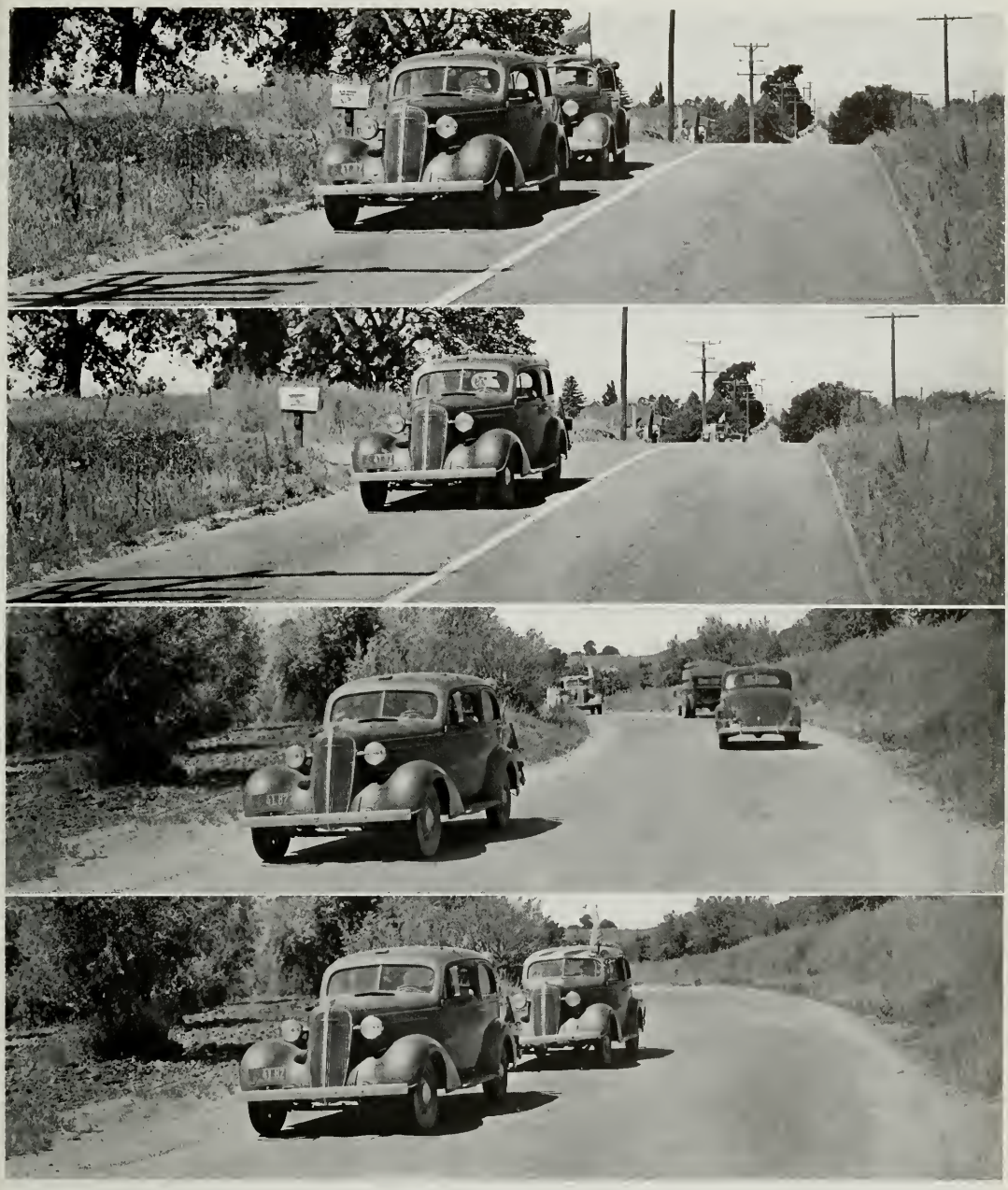
The instrument for measuring the radii of horizontal curves—the curvometer—was attached to the No. 1 car. Those for determining the superelevation on curves and for measuring the rate or per cent of grades were called a superometer and gradometer, respectively, and were attached to the No. 2 car.

The curvometer, of the protractor type, was made of plywood in the form of a half circle of the same diameter as the steering wheel and attached with brackets to the dash about two inches under and parallel to the wheel. A pointer was attached to the top of the wheel on the exact center when the car was driven on a tangent.

(Continued on page 23)



Meters used in sight distance survey. Left—Curvometer attachment on steering wheel of survey car used to measure curvature of highway. Right—Superometer mounted on car dash to measure superelevation and gradometer mounted on door to measure per cent of grade.



These pictures show Division of Highways sight distance survey party at work. Upper—Gradient being measured. Next—Taking measurement of limited sight distance on vertical curve. Next—Measuring limited sight distance on horizontal curve. Lower—Measuring curvature and superelevation.

Construction Progress and Pavement Records for 1936

By EARL WITHYCOMBE, Assistant Construction Engineer

THE outstanding feature in highway construction in California during the year 1936 was the preliminary treatment of subgrade, prior to the placing of pavement, particularly for asphalt concrete and Portland cement concrete types. The improvement of both the foundation and the immediate subgrade are of primary importance, and too much emphasis can not be placed on the most careful and scientific analysis and proper treatment of these factors in pavement construction. A brief description of the methods employed is given below. Details of pavement construction and records are shown in accompanying tabulations.

GRADING AND PAVEMENT FOUNDATION

Foundation Important

The roadway, which is identical to any other engineering structure, should rest on an unyielding foundation in order to secure best results. Insecure foundation conditions are largely the result of subsurface saturation, and wherever possible, areas which can not be readily drained and corrected are avoided in the location stages of highway design. It becomes necessary, however, at times to construct pavements over isolated areas of this description, and by means of boring tests the extent of such instability is approximately determined. Once determined, it becomes a question of economics as to the proper method of correction.

Methods Used

The methods used in California, listed as to their feasibility and order of consideration, are as follows:

(1) Dewatering by gravity flow induced by subsurface drains
(2) Removal and replacement of the unstable material
(3) Building of an embankment strut between the unstable mass, if dry, and an adjacent stable geological structure
(4) Construction of a stable roadbed by means of a systematic overloading of the roadbed area to obtain displacement of underlying mud and followed by removal of surplus overload to the planned elevation
(5) The construction of vertical drains for dewatering underlying mud

The first four of these methods are in quite common use by highway engineers. It has become general practice in California construction to supplement methods (1) and (2), wherever rock is available, by excavating a toe trench to solid foundation on the lower side of the unstable area and backfilling with as coarse rock fragments as are available. This type of submerged gravity rock toe wall is particularly effective under a variety of conditions.



Fine example of 20-foot asphalt pavement laid on a 3.8 mile section of highway near Vacaville in Solano County.



This is a sample of 20-foot road-mix oiled surface on a 10.9 mile section of highway in Riverside County, west of Indio.

New Departure

Method (5) is particularly worthy of description, as it is comparatively new and was originated by the Division of Highways. This method consists of sinking a large diameter well casing to the bottom of the unstable area and as the casing is removed, filling the hole with a porous and granular aggregate. The spacing of the vertical drains must necessarily be on rather close centers, which makes the method rather expensive. On the limited experimental sections constructed to date, it would appear that the rate of consolidation of the unstable material under the load of the superimposed roadway is greatly accelerated, and if sufficient time can be permitted between the construction of the roadway and the final paving, distortion of the riding surface may be minimized. Lateral movement of the unstable area during consolidation, however, may decrease the effectiveness of this method, and reasonable care must be exercised in the construction. It is necessary to connect the tops of the vertical drains, by means of porous subdrains, to a convenient outlet.

"Well, my pal has joined the silent majority."

"Dead, eh?"

"Married."

STABILIZATION OF SUBGRADES

Stabilizing of subgrades is generally accomplished with a blanket course of suitable material of sufficient depth to distribute the load to limits well under the maximum bearing power of the underlying materials. Where suitable blanket material is difficult to obtain, consideration is given as to whether an admixture can economically be added to the native soil, or the road relocated in a more favorable locality.

Even the most economical of foundation treatments is an expensive procedure and has resulted in considerably increased cost of construction. In general, however, the decrease in subsequent maintenance expenditures and the increased convenience to the traveling public have adequately justified the added expense.

PORTLAND CEMENT CONCRETE

Construction Methods

The conventional methods of finishing were used throughout the 1936 season's work. Due to the difficulty in obtaining floatmen with experience, an effort was made to reduce the weight of finishing tools, especially the floats, to make them more workable by the average individual.

Joint Construction

All transverse joints are doweled with $\frac{3}{4}$ inch round steel bars on 14-inch centers. The only other steel used is the $\frac{1}{2}$ inch square reinforcing bar fixed by chairs driven into the subgrade to support each end of the dowels, and the longitudinal tie-bars at selected locations. Wherever subsequent movement was anticipated in high embankments, tie-bars were used across the longitudinal joint consisting of $\frac{1}{2}$ inch square bars in longitudinal weakened plane joints, and threaded sleeve-connected $\frac{3}{4}$ inch bolts placed along longitudinal construction joints.

The joint interval was almost uniformly 20 feet, with provision made for $\frac{1}{2}$ inch expansion at each 60-foot interval.

Mixtures

Considerable reduction in the cement content was undertaken during the past season. Forty-nine per cent of the season's mileage was constructed of concrete with but five sacks to the cubic yard. Provision was made in the specifications to

(Continued on next page)

PORTLAND CEMENT CONCRETE PAVEMENT RECORDS FOR 1936

Location	Contractor	Resident Engineer	Street Assistant	Average cu. yds. laid per 8-hour day	Average strength of concrete, 28 days—lbs. per square inch.	Per cent average daily variation in cement	Roughness index, inches per mile
South Entrance to Red Bluff	N. M. Ball Sons	M. Fredericksen	A. Bigelow	199.0	4589	1.01	11.6
Plumas St., Bridge St.—Scott St., in Yuba City	Leo F. Piazza	J. P. Murphy		48.3	4248	3.80	---
M St. Subway—Sacto. River Brg.	A. Teichert & Son	J. D. Greene	R. T. Williams	126.4	3087a	2.13	18.6
Folger Ave. Subway—9th St.	L. C. Seidel	L. G. Marshall	H. M. Chapman	190.7	4793	1.78	18.0
SF Bay Bridge—Folger Ave.	Hanrahan-Wilcox Corp.	L. G. Marshall	J. O. Dietschy	114.3	4780	.85	8.5
Tajiguas Creek—Arroyo Hondo	Granfield, Farrar & Carlin	V. E. Pearson	F. C. Weigel	370.4	4455	.50	5.2
¼ mi. S. of Kern Co. Line—Fort Tejon	Griffith Company	F. M. Reynolds	C. C. Hinsdale	355.5	3427b	.74	4.9
At Walnut Canyon	C. F. Robbins	G. R. Halton	H. D. Johnson	239.8	4498	2.10	8.9
Little Sycamore Canyon—Encinal Canyon	Oswald Bros.	C. N. Ainley	G. H. Lamb	372.7	4074	.44	10.8
Seal Beach—Newport Beach	Geo. R. Curtis Co.	W. D. Eaton	E. E. Jackson	463.0	4412b	.70	8.0
Oxnard—Hueneme Road	J. E. Haddock	G. E. Farnsworth	G. H. Lamb	444.1	5496	.96	12.7
At Newport Beach	Mundo Engineering Co.	L. R. McNeely	H. D. Johnson	240.8	3980	1.50	12.2
Rosemead Blvd., San Gabriel Blvd.—Ramona Blvd.	C. O. Sparks	C. P. Montgomery	H. D. Johnson	303.5	5172	.86	7.9
Sepulveda Blvd., Lincoln Blvd.—Centinella Ave.	Match Bros.	C. N. Ainley	G. H. Lamb	432.0	3804	.56	5.5
Route 19—Anaheim-Spadra Road	C. R. Butterfield	H. B. Lindley	H. D. Johnson	325.7	5570	.72	12.0
Between Club Road and El Circulo	J. E. Haddock, Ltd.	G. E. Farnsworth	J. R. Rubey	272.0	5039	3.28	13.9
Gypsum Creek—Riverside County Line	Gibbons & Reed	F. B. Cressy	W. T. Lamb	418.8	4306	.65	7.1
Santa Ana River—Alabama St.	Matich Bros.	J. M. Hollister	W. H. Crawford	358.1	3865b	1.06	12.8
Rosemead Blvd., Longden Ave.—Fairview Ave.	J. E. Haddock, Ltd.	C. P. Montgomery	A. G. Black	389.3	5953	1.22	6.1
1 mi. N. of Carquinez Br.—Cordelia	Hanrahan-Wilcox Corp.	A. N. Lund	L. E. Ford	690.0	3636b	.92	25.9
2.2 mi. West of Indio	B. G. Carroll	R. C. Payne	L. B. Munro	290.7	4321	.68	13.2
			Averages	380.5	4180	.85	12.1

[a] 10-day break, early hardening cement.
[b] Class B concrete, average strength, 3740.
Class A concrete average strength, 4550.

ASPHALT CONCRETE PAVEMENT RECORDS FOR 1936

Location	Contractor	Resident Engineer	Street Assistant	Average tonnage laid per day	Average stability of surface mixture in lbs.	Average relative specific gravity of surface mix %	Roughometer index, inches per mile
Corning—Proberta	Peninsula Paving Co.	M. Fredericksen	V. M. Douglas	247.4	32%*	93.9	11.6
C Street—American River	A. Teichert & Son	J. P. Murphy	V. J. Braker	472.0	35%*	91.2	19.3
Yolo Causeway—M St. Subway	A. Teichert & Son	J. D. Greene	W. W. Greer	526.0	2358	92.7	19.1
SF Bay Bridge—Folger Ave.	Hanrahan-Wilcox Corp.	L. G. Marshall	J. W. Smith	488.7	2185	96.0	14.6
34th St.—7th St., Oakland	Hanrahan Company	F. W. Montell	J. W. Smith	601.7	26%*	95.9	11.5
12th St., 20th Ave.—29th Ave.	Heafey-Moore Co.	F. W. Montell	E. W. Strandberg	165.9	2825	87.0	17.2
Richfield Tower—Santa Maria River	Heafey-Moore Co.	H. J. Doggart	B. G. Stone	305.0	2930	96.1	11.5
Approach to Marengo St. Bridge	Tomei Construction Co.	W. D. Eaton	E. H. Dewing	256.8	3462	---	105.8
Verdugo Road—Flintridge Country Club	Geo. R. Curtis Paving Co.	W. J. Calvin	A. L. Hawkins	579.7	2960	95.6	14.9
San Fernando Road through Newhall	Geo. R. Curtis Paving Co.	E. L. Seitz	A. W. Carr	504.9	3550	96.1	11.4
At Newport Beach	Mundo Engineering Co.	L. R. McNeely	H. D. Johnson	422.0	39%*	94.3	31.7
Fenwick St.—Scoville Ave., Sunland	Southwest Paving Co.	M. H. Mitchell	H. C. Loose	304.2	2470	97.7	21.5
San Fernando Rd.—Central Ave., Glendale	Southwest Paving Co.	G. E. Farnsworth	A. W. Carr	292.1	3250	96.7	50.8
Traffic Circle—Los Angeles St.	Sully-Miller Co.	E. A. Parker	A. W. Carr	642.2	2764	97.3	14.6
Chapman Ave. and Glassell St.	C. O. Sparks	H. B. Lindley	A. W. Carr	173.6	3344	96.2	16.1
Camarillo State Hospital roads	Oswald Bros.	P. E. Ruplinger	A. W. Carr	261.7	3444	92.0	18.8
3.7 mi. N. of Fairfield—0.6 mi. S. of Vacaville	Union Paving Co.	A. K. Nulty	E. D. Bulton	694.0	2975	93.9	13.0
			Averages	447.0	2650	94.3	14.7

* Stabilometer Test.

blend fine sand with the ordinary commercial product, but on only one job was this found necessary. These mixtures are somewhat harsh, but it was demonstrated during this season that excellent results could be obtained with such reductions in cement.

The vibration method of placing concrete was set up as an alternate method in the specifications, but no contractor has seen fit to avail himself of this opportunity. An attempt was made to substitute vibration along the side forms in lieu of spading by means of trailing individual

BITUMINOUS TREATED SURFACE RECORDS FOR 1936

Location	Contractor	Resident Engineer	Roughness, inches, per mile
Plant Mix			
S. City Limits Eureka—Wabash Ave.	Mercer-Fraser Co.	J. C. Black	26.8
1.5 mi. E. of Bella Vista—Diddy Hill	Peninsula Paving Co.	L. H. Williams	31.3
Kyburz—Strawberry	Union Paving Co.	W. G. Remington	25.9
4 mi. N. Willows—1 mi. S. of Artois (por.)	N. M. Ball Sons	E. Hay	76.3
Donner Lake—Truckee	Pacific States Const. Co.	G. M. Leatherwood	32.0
Walnut Grove—Freeport (por.)	A. Teichert & Son	J. D. Greene	15.6
4.5 mi. NE. of Tahoe City—Nevada Line	Hemstreet & Bell	J. C. Womack	38.1
Dunnigan—Arbuckle	Hanrahan Co.	H. D. Ragan	48.2
Main St., Second St.—Elm St.	A. Teichert & Son	J. D. Greene	41.8
Orland—Northerly boundary	N. M. Ball Sons & Larsen Bros.	A. P. Bosworth	22.7
Folger Ave.—Camelia St.	Hanrahan Co.	L. G. Marshall	33.5
In Oakland at Berkeley Line	Hanrahan Co.	L. G. Marshall	18.3
Soledad—Gonzales	A. J. Raisch Co.	J. C. Adams	28.8
Lincoln St.—W. City Limits, Salinas	Granite Construction Co.	A. L. Lamb	70.1
Somis—Saticoy	Oswald Bros.	P. E. Ruplinger	35.4
Clark—Sudden Barrancas	Kovacevich & Price	B. N. Frykland	25.8
At Teague—McKevett Crossing	Dimmitt & Taylor	B. N. Frykland	35.2
Beaumont—San Bernardino County Line	Oswald Bros.	D. J. Stout	48.2
Verdemont—0.8 mile west	Geo. Herz & Co.	C. E. Malkson	14.2
At Little Mountain Entrance to San Bernardino	Geo. Herz & Co.	J. M. Cowgill	29.2
In Benicia	Louis Biasotti & Son	A. L. Tschantz-Hahn	220.9
Turlock—Keyes	S. M. McGaw	R. C. Clarke	43.2
4 mi. W. of Westmorland—Trifolium Canal	Oswald Bros.	F. B. Stewart	23.7
1.4 mi. S. of Thermal—Jct. Rte. 26	R. E. Hazard & Sons	J. M. Hodges	22.1
		Average	33.5
Road Mix			
Adin—Rush	Fredericksen & Westbrook	H. F. Caton	68.2
Ede's Ranch—Beckwourth Pass	A. Teichert & Son	C. A. Potter	19.7
1.5 mi. N. of Meyers	J. R. Galbraith & D. A. Canevari	H. F. Sherwood	---
Knights Landing—Robbins	Hanrahan Co.	J. W. Corvin	32.8
Lewis Creek—Priest Valley	Young & Son	E. F. Carter	90.8
3 mi. N. of Big Sur—Molera Ranch	Granfield, Farrar & Carlin	K. B. Knudsen	54.0
Bear Valley—1 mi. N. of Willow Creek	Union Paving Co.	R. Windele	43.3
1 mi. E. of Santa Inez—Los Olivas	Oswald Bros.	V. E. Pearson	64.2
1 mi. E. of Cholame—Kern Co. Line	A. Teichert & Son	C. R. Burns	33.4
Hollister Ave.—Painted Cave Road	Granfield, Farrar & Carlin	V. E. Pearson	14.8
4.5 mi. S. of Shafter—Shafter	Southern Calif. Roads Co.	J. W. Cole	26.0
Eric—La Rose	A. Teichert & Son	O. G. Evans	16.5
3 mi. NE.—4 mi. NE. of Taft	John Jurkovich	R. M. Reynolds	37.9
Yokohl—1 mi. N. of Lemon Cove	Union Paving Co.	C. F. Oliphant	39.4
West Casitas Pass—East Casitas Pass	Daley Corporation	W. L. Welch	22.9
East Casitas Pass—Coyote Creek	C. F. Robbins	W. J. Calvin	49.7
Camarillo State Hospital roads	Dimmitt & Taylor	B. N. Frykland	26.2
Santa Ana River—M St. Colton	B. G. Carroll	E. A. Bannister	20.5
Los Angeles County Line—Pipe Line Ave.	Dimmitt & Taylor	O. J. Stout	33.0
1 mi. NW. of Lake Arrowhead—Lake Arrowhead	Geo. J. Bock Co.	G. E. Malkson	21.1
Westerly Bdy.—Route 59	Basich Bros.	C. V. Kane	41.0
Near Third St., Barstow—0.6 mi. East	Matich Bros.	O. B. Brinkerhoff	45.6
10 mi. W. of Indio—Indio	Sharp & Fellows	E. L. Evans	18.3
Big Pine—Keough Hot Springs	Basich Bros.	A. C. Briney	12.1
3 mi. N.—12 mi. N. of Mojave	A. S. Vinnell Co.	C. M. Rose	23.0
2 mi. S. of Rush Creek—2 mi. N. of Leevining	Basich Bros.	A. C. Briney	29.4
Sullivan Creek—3.5 mi. East	Union Paving Co.	G. R. Hubbard	32.3
3.5 mi. E. of Sullivan Creek—Pooley's	M. J. B. Construction Co.	G. R. Hubbard	29.4
		Average	30.0
Miscellaneous Types			
Putah Creek—Davis	E. F. Hilliard	M. E. Ryan	83.4
Scott's Valley—1 mi. N. Santa Cruz	Peninsula Paving Co.	A. Walsh	28.9
Stony Point Road—Cotati	N. M. Ball Sons	H. A. Simard	144.2
Across Thompson Gulch	A. Teichert & Son	H. J. Doggart	75.6
Bolsa Ave., Bay Blvd.—Bolsa Chica Rd.	Sulley-Miller Co.	T. B. Cressy	47.9
		Average	60.0

units over the surface adjacent to the side forms, but this proved to be unsuccessful.

Construction Records

The **maximum average daily output** of Portland cement concrete pavement, reduced to an 8-hour comparative basis, was placed on Contract 810TC2-510TC2-410TC8, road X-Sol, Nap-7, 8-FGHA, 1 mile north of Carquinez Bridge to Cordelia, by Hanrahan-Wilcox Co., 690 cubic yards being produced by two pavers. A. N. Lund was the resident engineer with L. E. Ford as street assistant. The maximum output for one paver was 463 cubic yards per day, on Contract 87VC9, road VII-Ora-60S1B,A, NptB, Seal Beach to Newport Beach,

(Continued on page 20)

Manchester-Firestone Boulevard Is Opened By Governor Merriam

By P. A. McDONALD, Assistant Engineer



Upper—Governor Merriam cuts ribbon to formally open Manchester-Firestone Boulevard, being assisted by Miss Bernice Legg and Miss Susanna Dudlex. On the Governor's right are Frank C. Balfour, Master of Ceremonies, and Chairman Harry A. Hopkins of the California Highway Commission. Lower—View of section of new highway.

GOVERNOR Frank F. Merriam, officials of the Department of Public Works, prominent Los Angeles County officials and civic leaders aided the citizens of Downey Saturday, June 26, in formally dedicating and celebrating the completion of Manchester-Firestone Boulevard through that community.

A program of speaking was held at the intersection of Firestone Boulevard and Downey Avenue, and the official opening of the boulevard took place in front of the speakers' stand when Governor Merriam cut a red ribbon held by two "ribbon girls," Bernice Legg, daughter of Los Angeles County Supervisor Herbert C. Legg, and Susanna Dudlex, daughter of Sam Dudlex, chairman of the day and prominent Downey citizen.

Following dedication ceremonies, a luncheon was served to one hundred and fifty guests at the Downey Women's Clubhouse, where Governor Merriam again spoke.

Supervising Right of Way Agent Frank C. Balfour acted as master of ceremonies at both programs.

Governor Merriam, in his address, told of the inauguration of the gasoline tax, of the many highways it has built, and of the fact that the demand for greater and more highways keeps well ahead of the ability to create the new traffic lanes, and urged that this source of revenue be retained for its intended purpose and not diverted to uses other than building and maintaining highways.

Assistant Director, Justus F. Craemer, in a short talk spoke of the traffic toll and highway accidents and urged greater caution in driving.

Carmel-San Simeon Highway at Last Becomes Reality

(Continued from page 2)

were almost continuously in progress. Great credit is due these engineering survey parties for their stout-heartedness in connection with this location work for they were at many places only able to obtain their information by being lowered over cliffs on ropes. It was surprising how quickly the engineers adapted themselves to this rugged country and acquired an agility resembling that of the mountain goat.

FIRST CONTRACT WORK

The first contract for construction was awarded to the firm of Blake & Heaney, who started in 1921 to grade between Piedra Blanca Lighthouse, approximately six miles north of San Simeon, to Salmon Creek. This contract was completed in December of 1924, having graded a road width 21 feet wide in cuts and 24 feet wide in fills.

In September of 1922, George Pollock & Company started work on a contract to grade between Anderson Canyon and Big Sur. This contract covers one of the most rugged areas along the coast and was fraught with difficulties such as have been experienced in but few places elsewhere in the State. When the natural slopes were disturbed great quantities of rock material came down in slides which caused considerable delay as well as danger to the men and equipment doing the work.

In one of these slides a power shovel was carried from the roadside down to the ocean 500 feet below where it was so completely wrecked it had to be abandoned. Great difficulty was encountered by this contractor in getting his equipment and supplies to the job on account of the very limited hauling facilities and finally he brought most of his materials through by launch and barge to a sheltered cove about midway of the job, where his camp was established.

CONVICT LABOR WORK

Following the completion of the Pollock contract in October of 1924, no further work was done on the Carmel-San Simeon highway, except maintenance, until 1927, when the

decision was made to utilize prison labor for the construction. The first prison labor camp was established near Salmon Creek in March, 1928, with accommodations for 120 convicts and 20 free men, who worked northerly from this point which was the northerly end of the first named contract above. The original intention in establishing the prison labor camp was to construct the road principally by hand methods, but this was found to be so slow and inefficient that it was later decided to bring in equipment, including shovels, scrapers, etc., and confine the convicts' operations to purely hand labor work such as drilling, constructing masonry walls, parapets, etc.

In July of 1928 another prison labor camp was established near the mouth of the Little Sur River about 18 miles south of Carmel, from which point the grading of the roadbed along the coastal cliffs between Molera's Ranch and Rocky Creek, a distance of 8 miles, was carried on. When this section of road was completed the camp was moved to Anderson Canyon where it remained until the completion of the work in June, 1937. Work from this camp was carried southerly from Anderson Canyon to Big Creek, which is approximately 46 miles south of Carmel.

Upon the completion of this section the same crew started working north towards Big Sur. The reconstruction and realignment of this section was the final work accomplished from the Anderson Canyon convict camp. The southerly convict camp working north from Salmon Creek carried construction through to Big Creek, moving the camp ahead as the work progressed to Willow Creek and later establishing the camp at Kirk Creek, which is about midway in the portion of road constructed by convict labor.

HUGE BLASTING JOB

One of the outstanding construction features on the work handled was, undoubtedly, the carving of a roadway around Limekiln Bluff, about 37 miles north of San Simeon. This is a massive promontory of solid granite rock, rising several hundred feet, nearly vertically from the ocean. A single charge of dynamite and black powder, totaling 34 tons, dislodged approximately 97,000 cubic yards of solid rock, of which, about 70,000 cubic yards was blown into the ocean. A total of 163,000 yards was eventually removed at this point, within a distance of 1,000 feet.

The two convict camps working toward each other met in September, 1934, and on the 18th day of that month, the final barrier was removed and a few official cars were driven through the entire distance from San Simeon to Carmel for the first time, although a considerable portion of the road was still what is known as a construction road, and only wide enough for one car, with steep detour roads down into the various deep canyons traversed.

BRIDGES ARE NUMEROUS

While this road work progressed from either end, it was necessary to construct short detour roads down into the canyons and cross the streams with short temporary bridges, which were later replaced with permanent structures. A total of 29 bridges have been completed between Carmel and San Simeon. There are still three structures to be completed to span the various streams along this route.

All bridges were designed and constructed under the direction of F. W. Panhorst, Bridge Engineer.

RIGHTS OF WAY

The Division of Highways is glad to acknowledge the generous cooperation of most of the land owners along the route. Rights of way in the undeveloped sections were generally donated and but few selfish individuals were encountered.

The most serious right of way problem, and the most costly right of way, was through the highly developed Carmel Highlands subdivision, about 4.5 miles south of Carmel. Through this subdivision the engineers made every effort to avoid destroying any of the features which tend to make the area one of the outstanding attractions on the route.

The Carmel-San Simeon section of the Roosevelt Highway either passes through or is in close proximity to the Pfeiffer Redwood Park and Point Lobos Reserve.

SUMMARIZATION

When construction work is completed the State will have moved 13,000,000 cubic yards of material, built 32 bridges, varying in size from small timber structures to the stately reinforced concrete arch at Bixby Creek, and have expended close to $9,000,000. The money expended covers all construction costs, the cost of engineering, and payments for right of way.

Another Needed Link of Olympic Boulevard Opened

FORMAL opening of Olympic Boulevard, between Bronson Avenue and Rimpau Boulevard in Los Angeles, was celebrated on July 1 by State, county and city officials and business groups of the Olympic Boulevard Improvement Association and other organizations.

The dedicated project, completion of which will be realized toward the end of July and in anticipation of which festivities were held, is one of the most essential lengths of the Olympic Boulevard undertaking. The new section is an opened and improved stretch, approximately three-quarters of a mile in length, between Bronson Avenue and Rimpau Boulevard, entailing a cost of around $100,000, financed out of gasoline tax funds, and is 100 feet wide between property lines, with a 74 foot roadway.

NEEDED DEVELOPMENT

Opening of this stretch between Crenshaw and Lucerne boulevards was through an area that had been about 95 per cent built up. The Olympic Boulevard development extends from Route 60 at Santa Monica, easterly to the east city limits of Los Angeles at Indiana Street, where it makes connection with Route 166, locally known as Anaheim-Telegraph Road.

Much credit for the progress made in this important project has been given to the Olympic Boulevard Improvement Association under the leadership of James C. Dolan, its president, also to Dr. J. Dryden Davenport, President of the Los Angeles Street Property Owners Association, and to the many individual property owners who have donated right of way for the improvement, of which approximately $1,200,000 of the State cooperative and ¼-cent gas tax funds have been set aside out of the 1937-39 biennium.

Mr. Dolan presided at the dedication which began after the severing by Miss Carlyn Frank of a ribbon stretched across the new boulevard.

From a platform erected nearby, a program of speaking was held in which Director of Public Works Earl Lee Kelly gave the principal address.

Record Made In Building Road Detour

By J. W. VICKREY
District Engineer

THE Division of Highways is at times called upon to do emergency quick-time jobs, in order to maintain uninterrupted traffic service, that tax the resourcefulness of a well trained organization to the limit.

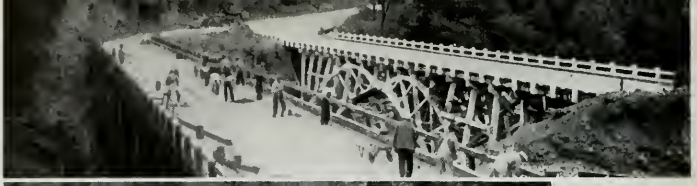
The old wooden truss bridge across Rock Creek, in northern Mendocino County, on the Redwood Highway suddenly and without warning "gave up the ghost" on April 21st. The bottom of the canyon at the bridge site is 150 feet below highway grade, and the sides are steep, rocky, and irregular, in all presenting a very uninviting location for quick bridge replacement.

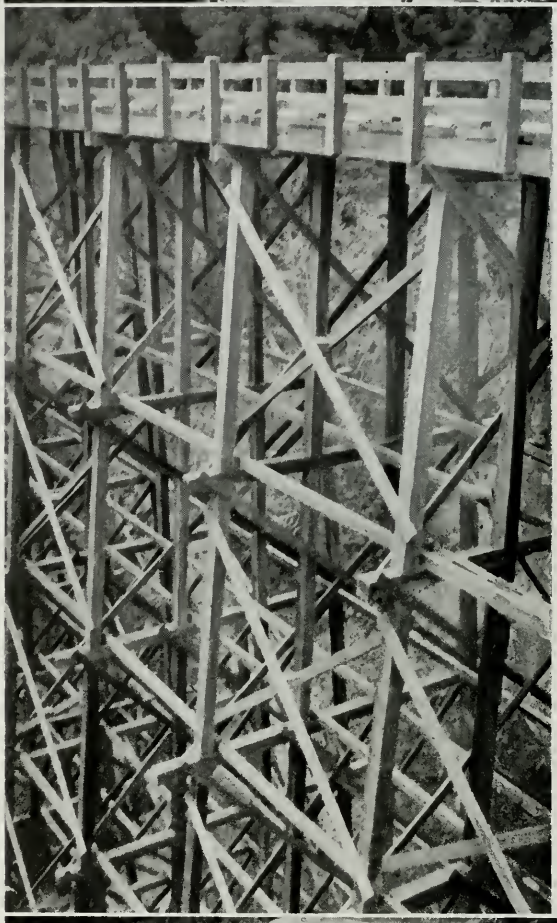
The construction of a detour around the bridge was, from a practical standpoint, out of the question and there are no roads parallel to the Redwood Highway in this part of the county. The total failure of the bridge meant a complete tie-up of the Redwood Highway and an isolation of Humboldt County from highway traffic almost equal to the "before the road was open" days.

The bridge members that had failed were quickly scabbed and the bridge kept open to automobiles and trucks of not over four tons total load. Excavation for footings for a new frame bent trestle were started on April 26th upstream and parallel to the old bridge.

The almost perpendicular sidewalls of the canyon required the removal of some 3,000 cubic yards of rock and shale in order to secure adequate footings. To accomplish this in quick time, a shovel and truck were dropped into the canyon with the high line that had been hurriedly set up to place the new bridge timbers.

Approach construction and framing of the 175,000 feet of timber proceeded concurrently with the excavation work, and trucks were permitted to cross the new bridge with legal loads on May 29th.





This trestle detour built in record time over Rock Creek was designed on the job by Al Lernhart and was constructed under the direction of Bridge Department engineers. The timber was framed under the direction of Ernie Smith, and the excavation and other necessary work under Carl Miller, Maintenance Superintendent. It is an interesting fact that these gentlemen directed the construction of the old bridge in 1916. The old bridge was designed in the District I office under the direction of Mr. Haselwood, now District Engineer at Redding, and was built by day labor forces. It was designed, so Mr. Haselwood states, to carry a 10-ton roller and to last for twenty years.





View of section of Maze Road between Modesto and Tracy which is boon to agriculturists.

Maze Road Relieves Traffic Problem

By R. E. PIERCE, District Engineer

ONE of the roads added to the State Highway System by the 1933 legislature, under the Breed Act, called locally the Maze Road, and which at present runs westerly from Modesto to the San Joaquin River, will be an important cross artery with the ridge and approaches completed under a previous contract, and further improvement east and west of the river now about completed.

The road originally proposed to be taken into the system, under this act, ran from Modesto to Westley with bridges over the San Joaquin and Tuolumne rivers. In general the roads taken into the State system by the 1933 act were existing traveled roads. The Maze Road is an exception to this rule, as no road existed across and to the west of the San Joaquin River.

The forward-looking people of Stanislaus County and especially of Modesto, had in mind for many years, a direct road connecting the San Francisco Bay area and Modesto, and extending easterly to Yosemite Valley, and action was taken through the board of supervisors to have the Maze Road made a part of this ultimate plan.

The board agreed to secure right of ways from the westerly end of the Maze Road to the westerly county boundary, and grade and oil surface their part of this new road lying east of the river, and with this assurance the Maze Road was made a State highway in lieu of the existing road to Westley, which, as shown on the map, is out of direction and has numerous sharp curves.

The San Joaquin County authorities also agreed to secure the right of ways and grade the road on the portion in their county, from the easterly boundary to Vernalis where it connects with Route 41, the West Side Highway.

Both the boards carried out their agreements except that as the oiling in Stanislaus County could not be completed by them, they turned over an amount of $3,000 to the State as the estimated cost of completing their obligations.

Funds for the construction of a bridge across the San Joaquin River were originally set up in 1934, based on building a fixed span. The War Department refused to grant a permit for the construction of a fixed span, and as no more money was available, it was decided to use this money for building a relocated road between Newman and Crows Landing, a much needed improvement on this important West Side Highway. Later the War Department withdrew their objection to a fixed span and the work was soon advertised and under way.

Funds at first set up were not adequate to complete even a graded and dust oiled road to connect with the West Side Highway at Vernalis, so

(Continued on page 28)

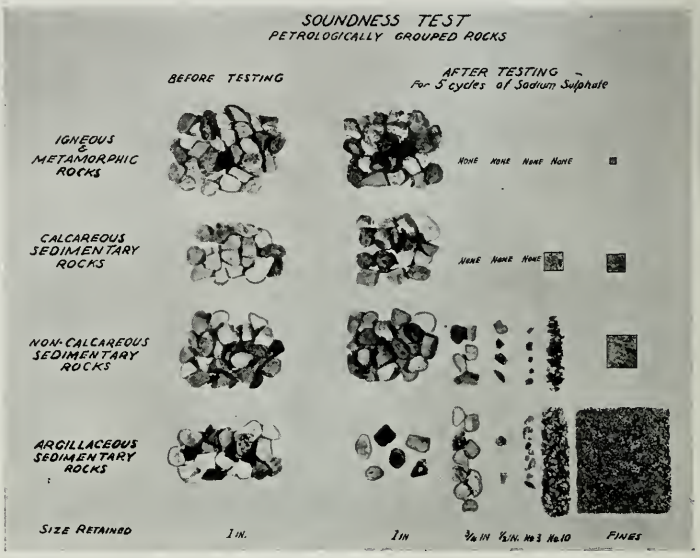
Selection of Aggregates for Portland Cement Concrete

By ALLEN NICOL, Junior Mineralogist, Materials and Research Department

THE purpose of this article is to describe briefly a few of the types of rocks which are commonly found in the aggregates of this State, with a discussion of their origin, mineral composition and suitability in highway use.

Aggregates comprise the coarse and fine rock matter used with water and cement to fabricate concrete. They consist then primarily of rock and sand. The rock particles above a No. 3 mesh are known as coarse aggregate, and below a No. 3 mesh as fine aggregate, chiefly sand.

The aggregates used in the construction of our concrete highways, bridges, subways and overhead structures are most commonly obtained from rivers and streams, or old river channels. A considerable amount of coarse aggregate is obtained from ledge deposits and crushed to suitable size. In ledge deposits the rock is usually of one type, whereas in river gravels the three main types of rock may be found all together.



Showing various forms of rocks before and after testing for Portland cement concrete use.

VARIETIES OF MINERALS

A mineral may be defined as any naturally occurring substance of definite composition forming part of the earth's crust. Rocks are aggregations of minerals, although one mineral alone may sometimes constitute a rock. Of some seventeen hundred known varieties of minerals but very few constitute the bulk of all rocks. One authority states that 99.9 per cent of the earth's crust is composed of only twenty minerals. These are the fundamental rock forming minerals, with which we are vitally concerned from an aggregate standpoint. Of these twenty minerals, a few have been found to possess properties which seriously affect the quality of any rock of which they are a part. Inasmuch as rock quality is our criterion in judging aggregates, the link between mineralogy and sound concrete highways is readily seen.

On the basis of origin there are three main types of rocks: igneous, sedimentary and metamorphic. Igneous rocks are those which have formed by the solidification or consolidation of molten magma, and are therefore primary rocks. Examples are granite, diorite and basalt.

TYPES OF ROCKS

Sedimentary rocks form from igneous rocks through the agencies of chemical action, wind action, freezing and thawing, and water. As these rocks break down, soluble particles are leached out and carried away in solution. Insoluble particles are carried in suspension, and both are eventually redeposited. These rocks are called secondary. Examples are limestone, shale and sandstone. The metamorphic rocks are formed from preexisting igneous or sedimentary rocks and are more or less completely changed from their original condition through the action of great heat, pressure, or both. Examples are gneisses and schists.

The three main types of rocks; i.e., igneous, sedimentary, and metamorphic, are each divided into hundreds of different varieties based on mineral composition, grain size or texture, occurrence, and other properties. No attempt will be made here to treat with the ramifications of these varieties, their peculiarities, and terminology. Considerable attention needs to be given to those streambed aggregates which carry rock types known to be deleterious. Such types may be detected through the abrasion and soundness tests as used in this laboratory. Special attention is given through the use of the petrographic microscope.

The three types of rocks are dis-

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Ribbon-cutting ceremony opening last link in Bay Shore Highway. Left to right are Timothy Reardon, State Director of Industrial Relations; H. Ray Judah of Santa Cruz, State Highway Commissioner; Earl Lee Kelly, with scissors, State Director of Public Works; Adron Beene, assemblyman, 30th district; Richard French, president San Jose City Council; Col. John H. Skeggs, district engineer; L. B. Lundborg, State Chamber of Commerce; Noa Gayle, president San Jose Chamber of Commerce; C. F. Price, resident engineer, and A. J. Raisch, contractor. Photo courtesy San Jose Evening News.

Last Link In Bay Shore Highway Dedicated

VISIONED more than thirteen years ago, the Bay Shore Highway connecting San Francisco and San Jose, heart of the rich Santa Clara Valley agricultural empire, became a complete unit of the State Highway System on June 12 with the official dedication to public service of the final 3.1 mile link from the Agnew Underpass to San Jose.

When Earl Lee Kelly, Director of the Department of Public Works, representing Governor Frank F. Merriam, snipped the ribbon stretched across the road his action signalized the completion of this $10,000,000 highway project.

The new unit connects the Agnew Underpass with the Oakland Highway near Gish Road. It is a divided highway with two 20-foot strips of concrete separated by an eight-foot section of bituminous surface.

FINEST HIGHWAY

"I consider this the finest highway in the State of California," said Col. Jno. H. Skeggs, Fourth District Highway Engineer, under whose supervision the road was built, who was one of the speakers at the dedication ceremonies. "There are no grade crossings, aside from spur tracks, except one in San Jose, which we hope to eliminate within the next year and a half. This highway link cost $230,000 to construct and is not designed as a high speed road, but a safe thoroughfare for all classes of traffic."

In a brief dedicatory talk, Director Kelly said:

"We have the finest highway system in the world, but so great has been the increase in automobile travel in California that we are ten years behind the times. The San Jose-Oakland and San Jose-Gilroy routes need new highways and we are now going ahead with plans for an east-shore highway on the Oakland side of the bay to San Jose."

OFFICIALS CUT RIBBON

With a pair of scissors, Director Kelly cut the barrier ribbon, which was held by Irene Tripp and Gladys Scott. He was assisted by Nao Gayle, president of the San Jose Chamber of Commerce, and Richard French, president of the San Jose City Council, who also wielded snippers.

Highway Commissioner H. Ray Judah of Santa Cruz; Timothy Reardon, Director of the Department of Industrial Relations, and Col. Skeggs made brief addresses.

Short talks were made by Mr. Gayle, Assemblyman Adron A. Beene, Richard French, president of the city council; Joseph M. McKinnon, supervisor; City Manager C. B. Goodwin; George Glans, president, Merchants' Association; L. B. Lundborg, manager of the central coast district, State Chamber of Commerce; Russell Pettit, manager of the local Chamber of Commerce, and I. B. Wright, assistant secretary, highway division of the State Chamber.

The dedication ceremonies were held under the auspices of the San Jose Chamber of Commerce and the California State Chamber of Commerce and were in charge of M. R. Bookwalter, chairman of the highway committee of the San Jose Chamber of Commerce.

A gentleman was walking down the street with his little boy at his side when the youngster cried out, "Oh, Pa! There goes an editor."

"Hush, hush," said the father. "Don't make sport of the poor man. Who knows what you may come to yourself some day."

Construction Progress and Pavement Records for 1936

(Continued from page 13)

Geo. R. Curtis Co., contractor, W. D. Eaton, resident engineer. The average daily output for the State during 1936 was 385.7 cubic yards, compared to 343.3 cubic yards in 1935.

Strongest Concrete

The **strongest concrete** placed during 1936 was on Contract 87XC18, road VII-LA-172-C, Route 19 to Anaheim-Spadra Road, with an average compressive strength of 5570 pounds. C. R. Butterfield was the contractor and H. B. Lindley, resident engineer.

Out of a total of 134,900 cubic yards of concrete pavement laid, 69,270 cubic yards, or 51.3%, was Class "A" mix, with an average strength of 4550 pounds, compared to 4965 in 1935. Four large pavement projects used 65,628 cubic yards of Class "B" concrete, being 48.7% of the total yardage placed, and having an average strength of 3740 pounds at 28 days.

Cement Control

The record for **cement control** was made on Contract 67VC24, road VII-Ven,L.A.-60-A, Little Sycamore Canyon to Encinal Canyon, with an average variation of 0.44%. Oswald Bros. were contractors, C. N. Ainley, resident engineer, with G. H. Lund, street assistant. The average variation for the State was 0.85%, compared to 0.93% in 1935.

Surface Smoothness

The record for **surface smoothness** was obtained on Contract 86VC1-46VC4, road VI-LA,Ker-4-DA, ¼ mile south of Kern County line to Fort Tejon, where the average roughness per mile was 4.9 inches. The contractor was the Griffith Company, F. M. Reynolds, resident engineer, and C. C. Hinsdale, street assistant. The average for the State was 12.1 inches per mile, compared to 9.3 inches in 1935. During 1936, the smoothest and the roughest riding qualities were encountered on projects constructed with 5-sack concrete, which seems to indicate that especial care must be exercised with reduced cement content mixtures in order to get good results. With the elimination of one such Class "B" rough project, the average roughness for the year is reduced to 9.0 inches per mile, which is comparable with previous years' records.

ASPHALT CONCRETE

Construction Methods

A decided improvement has been made in the average riding qualities of asphalt concrete during the past season, which is largely due to the improved equipment used to spread and to roll the mixtures, to the use of better methods in straightedging, and to better-trained personnel. Contractors have generally discarded obsolete equipment and provided the latest improvements when replacements were made. The marking straightedge, similar to that described in the February, 1937, issue of California Highways and Public Works, has been generally used throughout 1936.

The large amount of asphalt concrete pavement laid during 1935 has given our construction personnel a wider training in laying this type of pavement, and that training has been reflected in the past season's work. It has been found necessary to increase asphalt contents to compensate for the inert asphaltenes which are disclosed in the petroleum ether solubility test. These increases in asphalt are contributing to the workability of mixtures and likewise aiding in obtaining smoother riding pavements. The increased asphalt should insure a longer service life in this type of pavement.

Construction Records

The **maximum daily output** of asphalt concrete was obtained on Contract 810TC1, road X-Sol-7-C, 3.7 miles north of Fairfield to 0.6 mile south of Vacaville, by Union Paving Co., 694 tons being produced per 8-hour day. A. K. Nulty was the resident engineer with E. D. Bulton as street assistant. The average daily output for the State was 447 tons during 1936, compared to 520.5 tons in 1935, the reason for the decreased

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Photograph of portion of 5.5 mile section of 30-foot Portland cement concrete pavement near Fort Tejon in Kern County.

How Aggregates for Portland Cement Concrete Are Selected

(Continued from page 18)

tinguished by different properties. Igneous rocks are composed of crystalline minerals interlocking with one another, are usually massive, unstratified and without fossils. Sedimentary rocks are composed of elastic, organic, and precipitated materials, usually welded into solid rock through the effect of pressure or cementation, but often lacking coherence or consolidation, and commonly distinguished by the presence of bedding or stratification and fossils. Metamorphic rocks often retain some trace of original structure, but their most distinguished feature is banding or foliation.

In classifying the durable rocks, most of the igneous and metamorphic types may be included.

Durable rock for Portland Cement Concrete is a type which has not been altered to any extent, and which contains no minerals likely to undergo alteration after incorporation into concrete. Further, the rock must be free of joints, fissures, or weak cleavage planes. These requirements apply to both igneous and metamorphic rocks. Due to their foliated character, however, a higher percentage of metamorphic rocks exhibit weak cleavages along which they may break. Schists show this weak tendency to a greater extent than do gneisses. The Los Angeles Rattler test is advantageous in determining these types of metamorphics. Soft decomposed igneous rock will also be detected in the rattler tests. The fine grained igneous rocks are generally more durable than the coarse grained.

ACIDIC ROCKS

Acidic rocks (those high in percentage of silica) are generally more resistant to normal weathering than the basic rocks (those deficient in silica and high in silicates of iron and magnesium). The reason for this is that silica (quartz, formula SiO_2) is a hard, resistant mineral that undergoes negligible change. The silicates of iron and magnesium, however, readily undergo oxidation, with the formation of new compounds. These minerals are not stable chemically, hence any rocks of which they are a part must of necessity be easily altered. The amphibole and pyroxene groups of minerals are examples of this class.

Mention has before been made that sedimentary rocks are the least durable of the three main types. Of the sedimentary types, shales are particularly unsatisfactory. They are of many different kinds, depending upon origin and composition. A shale is a compact rock composed of welded argillaceous material in which the average size of grain is less than .01 mm., and shows good bedding along which it splits readily.

The minerals of shales are often difficult of positive identification because of their extremely fine state of subdivision, but consist mostly of hydrated silicates of aluminum, hydrated iron oxides, finely divided mica, some calcareous and carbonaceous matter, sulphide of iron, and other fine particles liberated by rock weathering. In spite of the enormous variations in shales according to their parentage and composition, they are to be regarded as nondurable so far as use in Portland Cement Concrete is concerned.

The sandstones are also sedimentary rocks of questionable durability. However, a well cemented sandstone, one in which each mineral grain is cemented to its neighbor, may be a durable type of rock for concrete. The nonporous sandstones and conglomerates also do not allow permeation of any soluble salts that may hasten breakdown either in actual use in concrete or in the soundness tests. The porous sedimentary rocks have shown, however, a decidedly weak resistance to the soundness tests as made in the Research Laboratory. In California, where large areas are covered by a mantle of sedimentary rocks from the Jurassic up to the Pliocene, shales, sandstones and conglomerates constitute the bulk of the beds. Shales of the Tertiary, particularly the Miocene, have been found to be extremely nondurable from observations based upon tests and upon field performance.

1936 Paving Records

(Continued from page 20)

average tonnage being the increased number of small projects.

The highest **average stability** of surface mixture was 3550 pounds, obtained on Contract 87VC2-67VC27, road VII-LA-23-H, San Fernando Road through Newhall, by Geo. R. Curtis Co., Contractor; E. L. Seitz was resident engineer with A. W. Carr, street assistant. The average stability for the State was 2650 pounds, compared to 2908 pounds in 1935.

The **densest surface mixture** was placed on Contract 87VC5-57-VC6, road VII-LA-9-LA, Fenwick Street to Scoville Avenue, Sunland, with a relative specific gravity of 97.7%. Southwest Paving Co., was the contractor and M. H. Mitchell, resident engineer. The State average was 94.3%, compared to 95% in 1935.

The **smoothest asphalt surface** was placed on Contract 87VC2-67VC26, road VII-LA-23-H, San Fernando Road through Newhall, with 11.4 inches per mile. The contractor was Geo. R. Curtis Paving Co., E. L. Seitz, resident engineer, and A. W. Carr, street assistant.

The average smoothness for the State was 14.7 inches as compared to 21.1 inches per mile in 1935.

BITUMINOUS TREATED SURFACES

The mileage of road-mix surfacing again predominated in 1936, there being constructed some 126 miles of this type as compared to 82 miles of plant-mix.

The record for surface smoothness of plant-mix, 14.2 inches per mile, was made on Contract 88VC7 in San Bernardino County, from Verdemont to 0.8 mile west, Contractor, Geo. Herz Co., and Resident Engineer, G. E. Malkson. The average roughness index for the State during 1936 was 33.5 inches per mile, compared to 36 inches in 1935.

For road-mix type, the smoothest surface was obtained on Contract 89VC1-49CS6 in Inyo County between Big Pine and Keough Hot Springs, with 12.1 inches per mile. The Contractor was Basich Bros., and Resident Engineer, A. C. Briney. The average roughness index for the State during 1936 was 30 inches per mile, compared to 37 inches in 1935.



Redwood Log Crib Saves Large Sum

By E. M. CAMERON, District Maintenance Engineer

DURING the winter of 1935-36 a portion of the highway constructed by the Bureau of Public Roads on Route 84 on the Trinity River, in Humboldt County, between Willow Creek and the Hoopa Indian Reservation, was washed out.

The location of the wash was such that to have thrown the line into the hillside to obtain sufficient width of roadway would have cost approximately $21,000 for original construction, without considering what would have to be expended later for removal of slides, as the material is of a very unstable nature. Protection of the slope from future erosion from the river was included in the above cost. It was decided, therefore to place a crib, constructed of redwood logs, as a protection from future erosion, which would act also as a retaining wall and permit the center line of the highway to remain in its original location.

This portion of Humboldt County is not in the redwood belt and it was therefore necessary to haul the logs in from the coast. The Hammond Redwood Company was low bidder on a contract to supply redwood logs for the crib at a price of $1.25 per lineal foot for logs 32 feet long with an average butt diameter of 30 inches. The length of haul was 90 miles.

The crib is approximately 120 feet long and the height 36 feet. The photographs show the crib at a time when it was nearing completion and gives an indication of the size of the structure as well as the location with respect to the Trinity River. The bottom log of the crib is below the ground elevation shown in the pictures. Construction was done by State forces under the direction of E. M. Cameron, District Maintenance Engineer, and G. W. Lane, Maintenance Superintendent.

The work involved and the cost, including the furnishing of logs, is given below:

Excavation	1633 Cu. Yds.	$1,273.71
Backfill	4576 Cu. Yds.	1,130.62
Logs in place	3688 Lin. Ft.	7,436.65
Total cost		$9,840.98



Upper picture shows size of Redwood crib on Trinity River to protect highway. Lower—View of river bed and road above where erosion occurred.

State Makes Extensive Highway Survey

(Continued from page 8)

To compensate for the play in the steering gear of the car, two zero points were drawn near the top center of the protractor. The car was then taken to a flat cleared area and, with the pointer on the wheel held at the one-quarter point on the protractor, driven in a complete circle. The radius of the circle was then measured and noted.

The car was next driven in complete circles with the pointer on the one-eighth and one-half points and the radius of each circle measured. From these measurements the protractor was calibrated and marked. It was later checked many times on highway curves of known radii and found to check within about 10 per cent on curves of 1,000 feet radius or less and about 25 per cent on curves from 1,000 feet to 1,500 feet radius. Radii of curves of more than 1,500 feet were estimated.

SUPEROMETER CONSTRUCTION

The superometer was constructed as follows. A piece of one-quarter inch diameter pipe, three feet long was attached horizontally to the dash of the car. A vertical pipe fifteen inches long was connected to the left end of the horizontal pipe with the necessary fittings, the upper end being capped and vented. On the right end of the horizontal pipe, a water gauge glass, 15 inches long, was connected vertically with specially made fittings. The top of the glass was also capped and vented. The pipes and glass were then filled with light valve oil to the middle of the glass. An adjustable vernier, calibrated to hundredths of a foot per foot, was attached to the gauge glass. It was found that when the car stopped on a curve, the oil came to rest at once, thus enabling the recorder to note the superelevation at a glance.

The gradometer was made on the same principle as the superometer and was attached to the inside of the right front door of the No. 2 sedan. The instrument was sturdy, easily read, and reasonably accurate.

TWO SURVEY CARS

The No. 2 car was equipped with an odometer registering to the hundredth of a mile, and frequent check was made of its accuracy. Car No. 1 had the usual type which shows tenths of a mile.

To facilitate intercommunication between the cars, spot lights, by which signals could be exchanged, were mounted on the top rear of No. 1 car and top front of No. 2 car.

With this equipment the party, consisting of four men, took the field on February 4, 1937. The survey was at first confined to the Sacramento and San Joaquin valleys and to routes in the southern part of the state where winter road conditions would not affect the progress of the work.

METHOD OF SURVEY

In surveying sections for which plans were available the party proceeded as follows: The odometers were set at zero at the beginning of a road section. Number 1 car then preceded No. 2 car at a distance of about 1,000 feet. When a curve was reached where the horizontal sight distance appeared to be less than 1,000 feet, Car No. 1 would stop at what, from the plans and the driver's own observation seemed to be the critical point of obstruction. Number 2 car would then close up until No. 1 car was again in sight. The odometer reading was recorded at this point, then recorded again after coming up to the position of No. 1 car. The intervening distance was recorded as the horizontal sight distance. The type of obstruction was also described on the log sheets.

Vertical sight distances previously computed in the office were checked by the field observations, and where not previously computed, were measured in the field in a manner similar to that used for horizontal sight distances.

RECORDERS MAKE NOTES

Car No. 2 was stopped on curves to record superelevation. The recorder in this car also noted length and type of traffic stripes, and the general topography of the country.

The recorder in the first car had a duplicate set of notes and by observing the odometer reading he kept the chief of party informed as to the beginning and end of curves, radius and vertical sight distances. Thus the chief of party was enabled to note any discrepancies between the notes and the road as constructed. In some instances it was found that curves had been omitted from the notes or that changes in alignment, which did not show on the plans, had been made under maintenance. These changes were recorded and later transferred to the original set of notes which was kept in the second car.

CLOSE FIGURING

On sections of road for which no plans were available the chief of party in Car No. 1, upon reaching the beginning of a curve, would read the odometer, estimating the nearest hundredth of a mile, and record this reading on the duplicate set of notes. As the car proceeded around the curve, the chief of party would call out the radius, as shown by the protractor, and this would be recorded opposite the beginning of the curve.

Where a curve was compounded, the first car would be stopped at the approximate point of compound and, by a prearranged signal with the spot light, the driver of the second car would be advised to note this point to the nearest hundredth of a mile when it was reached.

Practically all the work in Southern California has been completed. Route No. 1 to the Oregon line and many routes in the west central part of the State are also included in the total, to date, of 4,816 miles of highway that have been covered.

TABLES WILL BE PREPARED

From the data secured tables will be prepared which will list the county, route and section, the Federal aid number, the U. S. Route number, the general topography, the location, sight distance and type of obstruction at each restricted sight. The type and width of surface, the type and location of traffic stripes, the number of lanes, the radii and length of horizontal curves, the length and per cent of all grades of three per cent or more will also be listed.

Preparation of these tables is simplified by the use of card punching and sorting machines.

The tables will later be consolidated into four principal tables for comparison with conditions in other States, by the Bureau of Public Roads.

Highway Bids and Awards for June, 1937

ALAMEDA COUNTY—Between Warm Springs and Irvington, 3.2 miles to be surfaced with plant-mixed surfacing and shoulders to be constructed of crushed run base and oil treatment applied thereto. District IV, Route 69, Section A. Union Paving Co., San Francisco, $24,978; Leo F. Piazzi, San Jose, $35,406; Chas. L. Harney, San Francisco, $26,185. Contract awarded to Jones & King, Hayward, $23,173.75.

ALAMEDA COUNTY—Crusher run base to be constructed and armor coat applied between Sunol and Dublin, about 2.4 miles. District IV, Route 107, Section B. Granite Constr. Co., Ltd., Watsonville, $17,786; E. A. Forde, San Anselmo, $19, 915; Jones & King, Hayward, $15, 947; Lee J. Immel, Berkeley, $18,105; Independent Constr. Co., Ltd., Oakland, $15,420. Contract awarded to Piazza & Huntley, San Jose, $14,847.50.

ALAMEDA COUNTY—Between Mountain House and Greenville, 8.4 miles, grade, surface with crusher run base and road-mix surfacing. District IV, Route 5, Section E. Chas. L. Harney & Piombo Bros., & Co., San Francisco, $960,124; D. McDonald, Sacramento, $932,054; A. Teichert & Son, Inc., Sacramento, $872,356; Morrison-Knudsen Co., Inc., and Geo. W. Condon Co., Los Angeles, $1,107,522; The Utah Construction Co., San Francisco, $1,137,433; Heafey Moore Co., and Fredrickson & Watson Const. Co., Fredrickson Bros., Oakland, $850,299; George K. Thompson and Company, La Canada, $993,969; Lewis Const. Co.-Odenhamer Const. Co., Oakland, $931, 579; Metropolitan Construction Co., Los Angeles, $882,093; George Pollock Co., Sacramento, $984,537; Macco Const. Co., Clearwater $882,267; Guy F. Atkinson Co., San Francisco, $927,800; D. W. Thurston, Los Angeles, $1,139,224. Contract awarded to Granfield, Farrar & Carlin, San Francisco, $848,193.40.

AMADOR AND ALPINE COUNTIES—Furnishing and applying liquid asphalt to 24.5 miles of roadway between Bartons and Picketts. District X, Route 34, Sections E, F, G, H, AB. Lambs Transfer Co., Long Beach, $9,533; Garcia Const. Co., Irvington, $13,440; A. Soda & Son, Oakland, $12,765; Oilfields Trucking Co., Bakersfield, $10,582; Lee J. Immel, Berkeley, $10,320. Contract awarded to Sheldon Oil Co., Suisun, $8,940.

COLUSA, YOLO AND BUTTE COUNTIES—Between Route 15 and Madison, and between Oroville and west branch of Feather River; about 27.5 miles, penetration oil treatment to be applied. District III, Routes 50 and 21, Sections A, ABC, B, E, F, Hilliard, Sacramento, $9,220; Lee J. Immel, Berkeley, $9,563; J. P. Breen, Sacramento, $10,420; Hayward Building and Material Co., Hayward, $9,472; Garcia Construction Co., Irvington, $9,965. Contract awarded to E. A. Forde, San Anselmo, $9,196.75.

CONTRA COSTA COUNTY—Between Walnut Creek and 3.5 miles northerly, about 3.5 miles to be surfaced with plant-mixed surfacing and shoulders to be constructed of crushed run base and oil treatment applied thereto. District IV, Route 75, Section B. Jones & King, Hayward, $27,145; Union Paving Co., San Francisco, $31,486; Leo F. Piazza, San Jose, $28,306; Pacific States Const. Co., San Francisco, $34,934; Contract awarded to Frederickson & Watson Const. Co., & Frederickson Bros., Oakland, $26,613.40.

DEL NORTE COUNTY—A reinforced concrete bridge across Myrtle Creek, 10 miles north of Crescent City and 0.24 miles of roadway to be graded and treated with asphalt. District I, Route 1, Section C. Contract awarded to F. O. Bohnett, San Jose, $50,644.50.

GLENN COUNTY—Between Willows and Artois, about 7.0 miles—portions to be graded and surfaced with asphalt concrete. District III, Route 7, Section B. Union Paving Co., San Francisco, $201,760; Hanrahan Co., San Francisco, $239,412. Contract awarded to N. M. Ball Sons, Berkeley, $193,698.30.

INYO COUNTY—Between Bishop and Owens River, 2.2 miles to be graded and road-mix surface treatment applied. District IX, Route 76, Section A. Oswald Bros., Los Angeles, $33,022; Young & Son Co., Ltd., Berkeley, $33,210; Claude Fisher Co., Ltd., Los Angeles, $34,270; A. S. Vinell Co., Los Angeles, $35,608; Triangle Rock & Gravel Co., San Bernardino, $36,801; Leo F. Piazza, San Jose, $38,392. Contract awarded to Basich Bros., Torrance, $27,-736.

KERN COUNTY—East of Monolith, 0.8 mile to be graded, roadmix surface treatment applied and a timber bridge to be constructed. District VI, Route 58, Section G. Wm. C. Horn Co., Pomona, $21,470; Dimmitt and Taylor, Los Angeles, $19,823; Basich Bros., Torrance, $20,119; A. S. Vinnell Co., Los Angeles, $20,396; Rexroth and Rexroth, Bakersfield, $21,436; Claude Fisher Co., Ltd., Los Angeles, $22,140; Triangle Rock and Gravel Co., San Bernardino, $24,940; John Jurkovich, Fresno, $24,986; United Concrete Pipe Corporation, Los Angeles, $25,156. Contract awarded to Young and Son Co., Ltd., Berkeley, $17,-110.60.

KERN COUNTY—Railroad Grade Crossing and approaches over Central Pacific Railroad between 3.03 and 2.56 miles south of Invokern, 0.5 mile to be graded and treated with liquid asphalt. District IX, Route 145, Section C. A. S. Vinnell Co., Los Angeles, $4,911; Oswald Bros., Los Angeles, $4,710; Rexroth & Rexroth, Bakersfield, $5,592; Young & Son Co., Ltd., Berkeley, $5,999. Contract awarded to Basich Bros., Torrance, $4,661.50.

KERN COUNTY—Between Maricopa and Taft, about 5.5 miles in length to be graded; plant mixed surfacing to be placed; road-mix surface treatment to be applied and a bridge with concrete deck to be constructed. District VI, Route 138, Section A. A. Teichert & Son, Inc., Sacramento, $133,640; Harms Bros. & N. M. Ball Sons, Berkeley, $141,508; Oswald Bros., Los Angeles, $146,034; Union Paving Co., San Francisco, $172,363; George Pollock Company, Sacramento, $178,339; Basich Brothers, Torrance, $162,600; Geo. K. Thompson Company, La Canada, $138,991; Southern California Roads Co., Los Angeles, $155,693; J. E. Haddock, Ltd., Pasadena, $154,951; Dimmitt & Taylor, Los Angeles, $145,277; Atlas Construction Co. and C. F. Robbins, Pasadena and Los Angeles, $156,159; Stewart & Nuss, Inc., and Oilfields Trucking Co., Fresno, $146,932; Hanrahan Co., San Francisco, $153,839. Contract awarded to Griffith Co., Los Angeles, $128,573.20.

KERN COUNTY—Between Rosedale and Route 141, 5.5 miles to be surfaced with plant-mixed surfacing and borders to be constructed. District VI, Route 58, Section L. Union Paving Co., San Francisco, $40,445; Oswald Bros., Los Angeles, $41,860; Griffith Co., Los Angeles, $42,266; Hanrahan Co., San Francisco, $42,795. Contract awarded to Piazza & Huntley, San Jose, $37,931.50.

KERN COUNTY—At Radenmacher, about 2.8 miles in length, to be graded and road-mix surface treatment applied. District IX, Route 145, Section B. Young & Son Co., Ltd., Berkeley, $14,895; M. J. Ruddy, Modesto, $15,905; A. S. Vinell Co., Los Angeles, $15,922; F. Embleton, Albany, $17,461; George K. Thompson & Co., La Canada, $18,102; Rexroth & Rexroth, Bakersfield, $18,447; William C. Horn Co., Pomona, $19,182. Contract awarded Basich Bros., Torrance, $13,465.

KINGS COUNTY—Between Kings River Slough and Halls Corner, 8.6 miles to be surfaced with plant-mixed surfacing and borders to be constructed. District VI, Routes 10, 125, Sections B, E. Stewart and Nuss, Inc., Fresno, $44,672; Union Paving Co., San Francisco, $46,351; Oswald Bros., Los Angeles, $48,205; N. M. Ball, Sons, Berkeley, $49,388.50; Hanrahan Co., San Francisco, $49,524; L. A. Brisco, Arroyo Grande, $51,468; Leo F. Piazzi, San Jose, $53,188. Contract awarded to Griffith Co., Los Angeles, $42,521.

LASSEN COUNTY—Road-mix surfacing to be applied. District II, Routes 29-73, Sections D, A, B. Harms Bros., Litchfield, $11,530; Garcia Constr. Co. Irvington, $14,-220. Contract awarded to George French, Jr., Stockton, $9,365.

LASSEN COUNTY—Between Termo and Madeline about 14.2 miles to be surfaced with crusher run base and penetration oil treatment applied. District II, Route 73, Section F. A. Teichert & Son, Inc., Sacramento, $44,418; Clifford A. Dunn, Klamath Falls, $44,500; J. A. Casson, Hayward, $44,265; Frederickson & Westbrook, Lower Lake, $46,587; E. B. Bishop, Orland, $45,690; Harms Bros., Litchfield, $47,112; Louis Biasotti & Son, Stockton, $49,452; Hemstreet & Bell, Marysville, $50,517; Lee J. Immel, Albany, $55,811; Hanrahan Co., San Francisco, $58,594. Contract awarded to Geo. Pollock Co., Sacramento, $38,327.50.

LOS ANGELES and ORANGE COUNTIES—At various locations about 33.9 miles, road-mix surface treatment to be applied to the shoulders. District VII, various routes. Oilfields Trucking Co., Bakersfield, $43,416; Matich Bros., Elsinore, $31,730; Griffith Co., Los Angeles, $34,752; Dimmitt & Taylor, Los Angeles, $33,672; A. S. Vinnell Co., Los Angeles, $33,936; Oswald Bros., Los Angeles $28,608. Contract awarded to So. Calif. Roads Co., Los Angeles, $26,244.

LOS ANGELES COUNTY—Between east limits of Los Angeles and west limits of Monterey Park, about 3.8 miles of existing roadbed shoulders to be road-mix surface treated. District VII, Route 26, Section D. So. Calif. Roads Co., Los Angeles, $10,493; Dimmitt & Taylor, Los Angeles, $8,687; Vido Kovacevich, South Gate, $8,155; Road Mix, Inc., South Pasadena, $9,576; A. S. Vinnell Co., Los Angeles, $9,715. Contract awarded to Oswald Bros., Los Angeles, $7,853.75.

LOS ANGELES COUNTY—Between Las Flores Canyon and West Channel Road, 7.1 mile road-mix surface treatment to be applied to shoulders. District VII, Route 60, Section B, LA. Oilfields Trucking Co., Bakersfield, $19,101; J. E. Haddock, Ltd., Pasadena, $18,474; Oswald Bros., Los Angeles, $16,799. Contract awarded to A. S. Vinnell Co., Los Angeles, $15,956.

MADERA COUNTY—Between Kelshaw Corners and Coarse Gold, 8.0 miles underdrains to be installed. District VI, Route 125, Section C. Bodenhamer Const. Co., Oakland, $29,469. Contract awarded to Milton A. Purdy, Oakland, $27,958.70.

MENDOCINO COUNTY—Between Sapp Creek and Pepperwood School, 3.1 miles to be graded and surfaced with plant-mixed surfacing. District I, Route 1, Section H. Piombo Bros. & Co., San Francisco, $161,572; Union Paving Co., San Francisco, $230,181; A. Teichert & Son, Inc., Sacramento, $189,068; Chas L. Harney, San Francisco, $241,254; D. McDonald, Sacramento, $155,875; Donald Atkinson, San Francisco, $184,864; John Carlin, San Francisco, $185,188; Harms Bros. and Larsen Bros., Sacramento, $188,138. Contract awarded to Hemstreet & Bell, Marysville, $155,753.

MODOC COUNTY—Between 1.4 miles west of Hot Creek and Alturas, 10.1 miles to be graded and surfaced with plant-mixed surfacing. District II, Route 28, Section B, Alt., Union Paving Co., San Francisco, $282,559; Harms Bros. and Larsen Bros., Sacramento, $196,097; A. Teichert and Son, Inc., Sacramento, $195,736; George Pollock Co., Sacramento, $249,266; Hemstreet and Bell, Marysville, $193,435; Harold Blake, Portland, Oregon, 217,862; D. McDonald, Saeramento, $219,299. Contract awarded to Hanrahan Company, San Francisco, $192,283.55.

MONTEREY COUNTY—Various locations between Greenfield and Salinas River, about 1.3 miles to be surfaced with plant-mixed surfacing. District V, Route 2, Section D. Contract awarded to Granite Construction Co., Ltd., Watsonville, $9,247.

MONTEREY COUNTY—Between San Ardo and King City and between Santa Rita and northerly boundary, 25.7 miles, roadmix surface treatment and seal coat to be applied to shoulders and class "B" seal coat to be applied to portions of existing pavement. District V, Route 2, Section J. Granite Construction Co., Ltd., Watsonville, $22,538. Contract awarded to L. A. Brisco, Arroyo Grande. $22,201.00.

NAPA COUNTY—Surfacing with imported surfacing material and Penetration Oil Treatment between Summit of Mt. St. Helena and Northerly boundary about 3.3 miles. District IV, Route 49, Section A., Lee J. Immel, Berkeley, $12,128; A. Soda & Son, Oakland, $14,380; Frank Embleton, Berkeley, $12,863; E. A. Forde, San Anselmo, $12,490; Rock & Gravel Trucking Co., Oakland, $12,402. Contract awarded to Harold Smith, St. Helena, $10,254.50.

NAPA COUNTY—Between west boundary and Napa, 4.7 miles surface with crusher run base and plant-mixed surfacing shoulders to be constructed. District IV, Route 8, Section A. Jones & King, Hayward, $48,150; Chas. L. Harney, San Francisco, $48,350; Granite Const. Co., Ltd., Watsonville, $51,446; Pacific States Const. Co., San Francisco, $52,402; Piazza & Huntley, San Jose, $52,468. Contract awarded to E. A. Forde, San Anselmo, $48,104.

ORANGE COUNTY—Newport Beach grade separation, existing southwest ramp to be widened and paved. District VII, Route 60, Section A. Sander Pearson, Santa Monica, $3,360; Vido Kovacevich, South Gate, $3,186; Thomas Construction Co., Burbank, $3,166; C. O. Sparks & Mundo Eng. Co., Los Angeles, $3,016; Mojave Corporation, Los Nietos, $2,993. Contract awarded to J. E. Haddock, Ltd., Pasadena, $2,420.

PLUMAS COUNTY—Between Howels and ¼ mile south of Keddie, 20.0 miles seal coat to be applied. District II, Route 21, Sections B, C. Lee J. Immel, Berkeley, $31,160; E. A. Forde, San Anselmo, $31,380; Heafey Moore Co. and E. F. Hilliard, Sacramento, $31,791; Geo. French, Jr., Stockton, $32,750; Frank Embleton, Albany, $33,245; Hemstreet and Bell, Marysville, $34,725. Contract awarded to Hayward Building Material Co., Hayward, $30,870.

PLUMAS COUNTY—A reinforced concrete girder bridge across Spanish Creek, ½ mile north of Quincy to be constructed. District II, Route 21, Section C. F. C. Amoroso & Sons, San Francisco, $43,925; F. O. Bohnett, San Jose, $45,282; Bodenhamer Const. Co., Oakland, $45,614; A. Soda & Son, Oakland, $49,004. Contract awarded to S. D. Bechtel, San Francisco, $41,750.50.

PLUMAS COUNTY—Between Feather River Inn and Beckwourth, 16.1 miles to be surfaced with road-mix surfacing and seal coat applied thereto. District II, Route 21, Section F. Geo. French, Jr., Stockton, $45,820; Harms Bros., Litchfield, $46,466; Pacific States Const. Co., San Francisco, $46,636; A. Soda & Son, Oakland, $49,389; F. A. Forde, San Anselmo, $51,605. Contract awarded to Fredericksen & Westbrook, Lower Lake, $37,014.

PLUMAS COUNTY—Between Almanor Inn and Route 29, 7.0 miles to be surfaced with road-mix surfacing. District II, Route 83, Section D. Lee J. Immel, Berkeley, $7,625; George French, Jr., Stockton, $7,740; Fredericksen & Westbrook, Lower Lake, $9,380. Contract awarded to Harms Bros., Litchfield, $7,110.

RIVERSIDE COUNTY—Furnish and apply liquid asphalt to existing shoulders between Indio and Desert Center, 45.1 miles. District XI, Route 64, Section H.I.B. Square Oil Co., Los Angeles, $16,383; Paulsen & March, Los Angeles, $11,372; Gilmore Oil Co., Los Angeles, $13,775; Lamb Transfer Co., Long Beach, $11,565; Oilfields Trucking Co., Bakersfield, $14,623. Contract awarded to Morgan Brothers, Maywood, $11,089.55.

RIVERSIDE COUNTY—Edom to 3 miles S. of Coachella; Indian Wells to Indio, liquid asphalt to be applied for a distance of 28.6 miles. District XI, Route 26-64, Section E, F, Q, Ind. Consumers Oil Co., Los Angeles, $4,834; Morgan Bros., Maywood, $4,833; Lamb Transfer Co., Long Beach, $4,703; Regal Oil Co., Long Beach, $5,215. Contract awarded to Paulseu & March, Los Angeles, $4,635.50.

SAN DIEGO COUNTY—Furnish and apply liquid asphalt to existing roadbed between Jamul and White Star, 13.5 miles. District XI, Route 200, Sections B, C, D, E. Square Oil Co., Los Angeles, $3,600; Paulsen & March, Los Angeles. $3,500; Oilfields Trucking C o.,Bakersfield, $14,623. Con-Oil Co., Los Angeles, $3,789; Morgan Brothers, Maywood. $3,654. Contract awarded to Regal Oil Co., Long Beach, $2,955.

SAN LUIS OBISPO COUNTY—Bridge to be constructed across Arroyo Laguna about 2 miles north of San Simeon. District V, Route 56, Section A. F. C. Stolte Co., San Simeon, $5,965; F. O. Bohnett, Campbell, $6,188. Contract awarded to Valley Const. Co., San Jose, $5,820.

SAN LUIS OBISPO COUNTY—At California Polytechnic School at San Luis Obispo, constructing tennis courts; furnishing and erecting court fence and nets; and painting playing lines. District V. F. C. Stolte Co., San Simeon, $4,164. Contract awarded to Granite Construction Co., Ltd., Watsonville, $3,212.24.

SANTA BARBARA and SAN LUIS OBISPO COUNTIES—Between Santa Maria and Gary and between Route 56 and 3 miles easterly, about 7.5 miles, road-mix surface treatment and seal coat to be applied to existing roadbed. District V, Route 148, 125, Section B, A. Harry L. Foster, San Diego, $12,280; Road Mix, Inc., South Pasadena, $13,071; L. A. Brisco, Arroyo Grande, $14,900. Contract awarded to Oilfields Trucking Co., Bakersfield, $12,238.

SHASTA COUNTY—Between Antler and north boundary 34.5 miles in length, mineral aggregates and screenings to be furnished. District II, Route 3, Section C, D. E. R. Bishop, Orland, $20,925. Contract awarded to Geo. Pollock Co., Sacramento, $19,404.

SHASTA COUNTY—At China Gulch, 0.7 mile to be graded and surfaced with crusher-run base and road-mix surfacing. District II, Route 3, Section A. Louis Biasotti and Son, Stockton, $28,627.25; A. Soda and Son, Oakland, $29,258.80; J. P. Brennan, Redding, $23,673; Piazzi and Huntley, San Jose, $23,209.75. Contract awarded to Lee J. Immel, Berkeley, $23,118.50.

SIERRA COUNTY—Between Sierra City and Route 83, about 17.6 miles liquid asphalt to be furnished and applied. District III, Route 25, Section B, C. C. F. Fredericksen & Sons, Lower Lake, $13,205; Sheldon Oil Co., Suisun, $12,988; Edward F. Hilliard, Sacramento, $12,580; Lee J. Immel, Berkeley, $11,968; Garcia Const. Co., Irvington, $13,872. Contract awarded to J. P. Breen, Sacramento, $11,764.

TEHAMA COUNTY—Between Route 86 and Morgan Springs, 3.8 miles to be surfaced with road-mix surfacing and seal coat applied thereto. District II, Route 83, Section A. A. Teichert and Son, Inc., Sacramento, $16,258.05; Louis Biassotti and Son, Stockton, $17,292.75; A. Soda and Son, Oakland, $17,461.25; Leo F. Piazzi, San Jose, $19,436. Contract awarded to Lee J. Immel, Berkeley, $14,881.

TULARE COUNTY—Constructing steel structure bridge across Kaweah River, 3.0 miles south of Woodlake. District VI, Route 129, Section E. Bodenhamer Const. Co., Oakland, $29,028; F. O. Bohnett, San Jose, $29,127; Peter J. McHugh, San Francisco, $29,739; R. R. Bishop, Long Beach, $30,642; F. C. Amoroso & Sons, San Francisco, $33,591; Schuler & McDonald, Inc., Oakland, $36,333. Contract awarded to N. M. Ball Sons, Berkeley, $27,331.80.

TUOLUMNE COUNTY—Between Stoddard Springs and McCoy Saddle, 6.2 miles to be surfaced with untreated crushed gravel or stone base and road-mix surfacing. District X, Route 13, Section E. George French, Jr., Stockton, $64,210. Contract awarded to Beerman and Jones and A. R. Maestretti, Stockton, $57,890.

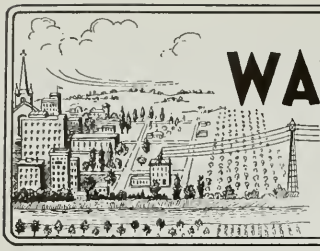
VENTURA COUNTY—Between 3.2 and 4.5 miles east of Santa Susana, about 0.5 mile in length, to be graded and paved with plant-mixed surfacing. District VII, Route 9, Section C, C. O. Sparks & Mundo Eng. Co., Los Angeles, $33,425; Dimmitt & Taylor, Los Angeles, $26,320; J. E. Haddock, Ltd., Pasadena, $25,629; C. F. Robbins, Los Angeles,, $28,337; Griffith Co., Los Angeles, $26,785; Oswald Bros, Los Angeles, $29,046. Contract awarded to A. S. Vinnell Co., Los Angeles, $23,380.

An 8.1 per cent increase brought the 1936 motor vehicle registration in Los Angeles county near the one million mark with a total of 994,927 passenger cars, trucks, trailers and motorcycles registered, according to State figures just released. Nearest competitor to Los Angeles was Alameda county with a total registration of 172,351. Entire registration throughout the State during 1936 was 2,448,925.

Mr. Brown was astounded to see in the paper an announcement of his death. He rang up his friend Smith.

"Hello, Smith," he said, "have you seen the announcement of my death in the paper?"

"Er—yes," replied Smith, "where are you talking from?"



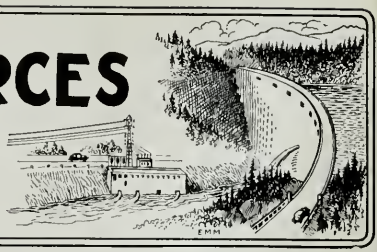
DIVISION OF WATER RESOURCES

OFFICIAL REPORT

FOR THE MONTH OF

June, 1937

EDWARD HYATT, State Engineer



At an election held June 16, the Imperial Irrigation District voted by a large majority for acceptance of contracts with the Federal Government and for issuance of revenue bonds to develop and distribute hydroelectric power from the All-American Canal. In addition to a grant of $1,242,000, the government has approved two loans to the district for this project. One in the amount of $1,518,000 from PWA for construction of power plants and main transmission lines, the other of $700,000 from REA for extension of distribution lines to rural areas in Imperial Valley.

Excavation work on the All-American Canal is 70 per cent completed. The balance of 11 miles is now under contract. Imperial diversion dam and desilting works on the Colorado River are reported to be 65 per cent completed.

IRRIGATION DISTRICTS

La Mesa, Lemon Grove and Spring Valley Irrigation District entered into contract and started work during the month on El Monte pumping plant which will link the district with the pipe line from El Capitan reservoir and eliminate the last stretch of old wooden flume constructed in 1888.

FLOOD CONTROL AND RECLAMATION

Relief Labor Work

Owing to lack of men all WPA projects have been discontinued, with the exception of WPA Project No. 6654 in Yolo County, on which an average of 25 men have been engaged during the period in cleaning levees and clearing brush in the Sacramento By-Pass.

Bank Protection Program

R. L. Jones, deputy in charge of Flood Control and Reclamation, with B. A. Etcheverry, consulting engineer for the Reclamation Board, appeared before the Board of Engineers for Rivers and Harbors on May 24th in Washington, D. C., and presented arguments to support a request that a modification be made in the recommendation of the California Debris Commission in its report of March 20, 1937, in respect to the division of cost and maintenance, particularly as to bank protection of the Sacramento Flood Control Project.

SUPERVISION OF DAMS

Application was filed on May 26, 1937, for approval of the Cannon Ranch Dam in Butte County. This is a small dam which was constructed many years ago.

Application was filed by the City and County of San Francisco on May 4th for permission to install observation wells on the San Andreas Dam. This application was approved on June 14, 1937.

Application was filed by the City and County of San Francisco on May 4th for permission to install observation wells on the Pilarcitos Dam. This application was approved on June 14, 1937.

Construction on the Mad River Dam for the city of Eureka has been resumed.

The enlargement work at the O'Shaughnessy Dam of the City and County of San Francisco is progressing rapidly and satisfactorily.

The Metropolitan Water District of Southern California is continuing work on the Cajalco Dam and work is being started on the Gene Wash and Copper Basin Dams.

Work of placing fill on the San Gabriel Number One Dam of the Los Angeles County Flood Control District is rapidly nearing completion and work is actively in progress on the construction of the spillway.

Repairs on several dams throughout the State are being made and a considerable amount of maintenance work is being done. Most reservoirs are practically full and maintenance and operations inspections are in full progress.

WATER RIGHTS

Supervision of Appropriation of Water

Twenty-seven applications to appropriate water were received during May, five were denied and thirteen were approved. During the same period, four permits were revoked and thirteen passed to license.

Inspection of projects under permit are being made during the current month in Plumas, Nevada and Sierra counties.

SACRAMENTO-SAN JOAQUIN WATER SUPERVISION

Field work is now being carried on in full force, measurements are being made of diversions, stream flow and return flow, and records of the same are being obtained.

The irrigation plants along the river are nearly all operating. Rice, fruit and sugar beets are the main crops being irrigated and when the grain is removed, additional land will be flooded for beans.

The Sacramento River has fallen rapidly but the rain in the valley on June 15-16 caused about a six foot rise in the vicinity of Knights Landing. However, this is only a temporary condition and the river should continue to fall. The flow at Sacramento on May 24th was 35,000 cubic feet per second, while on June 21st it was 17,500 cubic feet per second.

The flow of the San Joaquin River at Lathrop on June 19th was 13,500 cubic feet per second.

CALIFORNIA COOPERATIVE SNOW SURVEYS

With the opening up of the mountain roads at high elevations during the past month, the snow surveying equipment that had been kept at the shelter houses during the winter was gathered up and collected at convenient central locations. Here it will be put in good repair, and stored away for distribution to the shelter cabins again next fall.

Work in the office has continued; previous forecasts are being given a final overall check, snowpack-runoff curves are being revised and brought up to date, and all supporting data gathered during the past autumn and winter are being reviewed and put into shape for permanent filing. Research work is being done regarding the snowpack-runoff relations in certain areas, where it is believed forecasts even more accurate than those obtained at the present time may be obtained by modifying the procedure at present followed in forecasting for these areas.

WATER RESOURCES

South Coastal Basin Investigation

Work on the South Coastal Basin Investigation, Southern California, continued along routine lines in the field and office during the month of June.

CENTRAL VALLEY PROJECT

The United States Bureau of Reclamation continued work during the month on the preparation of plans necessary for starting construction on the initial units of the project. Preliminary investigations and exploration work have been continued.

New Highway Leads to Death Valley

Reconnaissance

(Continued from page 6)

furnished transportation across country until boulders too large and numerous to permit further travel were encountered. From there on exploration was conducted on foot.

Reconnoitering the easterly side of this plateau was fairly simple, the terrain allowing easy alignment and gentle grades, but descending from this plain into Panamint Sink, which lies at an elevation below 2,000 feet, brought one face to face with a variety of canyons extending westerly into the range from the floor of the sink. To overcome the difference in elevation meant much looping and curving of line, but by hanging precariously to lava rims, dodging basalt cliffs, and meandering around cinder cones, a satisfactory route was obtained at last, and one that joined the present road at the mouth of Darwin Wash. Alignment and gradient standards were met at economical cost, cloudburst conditions were minimized, and the first step in a new road into Death Valley was accomplished.

Survey and Plans

(Continued from page 6)

first, a far glimpse of Panamint Sink from between its high walls, then a clear view of its colorful depths from a closer point of vantage.

Steadily dropping, we followed our grade contour into and out of canyons, around ridges, across washes, reversing our direction time after time in an effort to lose elevation on ground that would lend itself to easy construction, yet maintaining a minimum radius curvature of 200 feet.

In this broken area, we experienced some difficulty in walking to and from our work, as it was found to be shorter to drive down Darwin Wash on the existing road, and then climb the escarpment above the wash to the site of our work. This entailed climbing approximately 2,000 feet and carrying all the paraphernalia of a survey party, including our water, which is at a premium in that country.

In the latter part of April, 1936, the field work was completed, a junc-

(Continued on page 28)

Construction

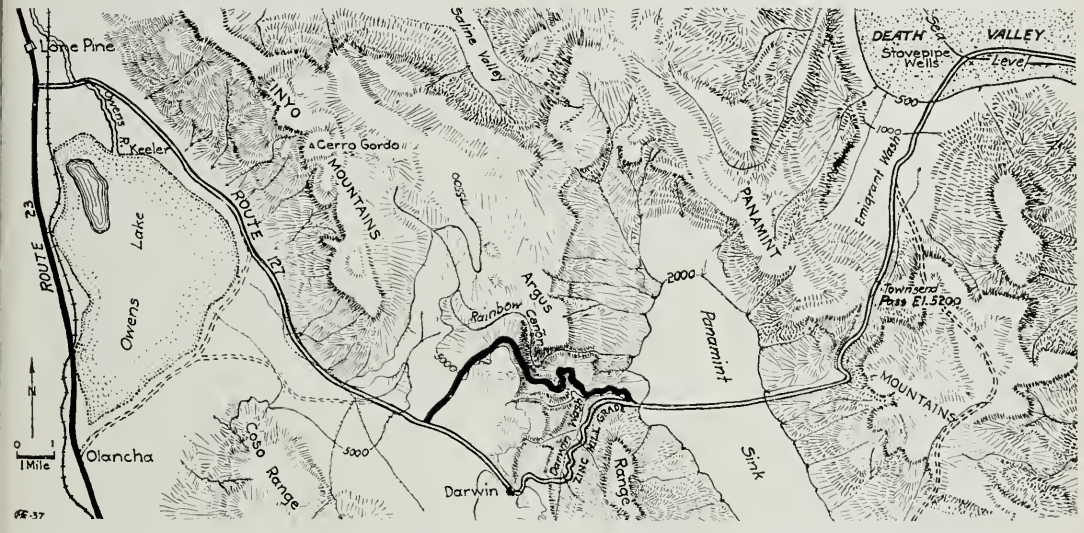
(Continued from page 6)

like a bar of steel when struck with a hammer, proved to be only a few feet thick and overlying a loose deposit of cinders.

A stratified limestone outcrop developed layers of such tenacity that a few inches of hole per hour was considered good progress, and drill bits had to be changed at the rate of 9 per foot of hole drilled.

Steady progress has been maintained by the contractor by means of double shifts, with the result that the completion of the work is scheduled for early in September of this year.

Local organizations are planning a jubilee pageant to mark the completion of this highway, commemorating the evolution of various modes of transportation into Death Valley. The passage of burro and miner, mule-team and freighter, truck and automobile over this new road, on that day, will mark the final step in the complete building of a safe and modern highway.



Sketch map shows location of new highway leading to Death Valley and avoiding Darwin Wash. Black line is realigned route.

Locating Death Valley Highway Was Hard Task

(Continued from page 27)

tion with the existing road established at the mouth of Darwin Wash, and the preliminary survey proved the fact that an economical line was possible with a maximum grade of 7.3 per cent for the last three miles, and a minimum radius curvature of 200 feet. This work was completed just in time, as the heat waves rising from the baked ground and glassy rocks were proving a factor which might prevent the completion of the work.

As the field work was progressing, the maps were being constructed in the field and district offices, and after the completion of the survey, the design of the final location was attacked in earnest. Aside from the usual procedure of balancing the excavation quantities, several factors arose that were of interest, and entailed a study to determine their relative values.

CLOUDBURST AREA

Here was a road through a cloudburst area, subject to an intense deluge concentrated in relatively small space, yet whose point of impact was as unpredictable as the striking of a bolt of lightning. Tons of water down a small wash—and dry ground a quarter of a mile away! Culverts to accommodate all drainage would cost a fortune, so the fills across the various depressions were designed to be permeable, and so allow whatever water struck them to pass through with but little restriction. In some of the larger washes which showed signs of having carried floods recently, a relief pipe was designed to be placed close to the top of the fill, just as a precautionary measure.

Cognizance was taken of the geological formations and wherever strata was encountered that was inclined in such a direction as to be in a position to slip into the roadway during construction, allowance was made for its removal and disposal.

FLOOD PROTECTION

To further the stability of fills under the action of rushing water, the upstream faces were flattened by the placing of additional material. In those localities where an unusually large amount of water would be expected, dips in the grade line were designed to allow the water to pass across the surface of the roadway instead of through the fill, and in these cases, the upstream faces were flattened to the extent of filling the washes level with the grade of the highway.

Due to the inaccessible location of the project, specifications were drawn so the project would be as attractive as possible to prospective bidders. Close finishing of the slopes was eliminated in this region as it was felt that the severe windstorms, which are prevalent, would soon undo whatever work man could accomplish, and so would be a total loss to the State.

End-dumping in the construction of fills was allowed as the material was, in general, very rocky, and subsoil investigation disclosed the fact that but little subsidence would result and shrinkage would be negligible. The time limit was placed at a very liberal date, and the requirement of water in compacting embankments was entirely eliminated due to its scarcity.

CURVATURE STATISTICS

As a result of this design, bids were opened on December 6, 1936—the Peninsula Paving Company of San Francisco being low bidder, and offering to complete the project for approximately 6.7% under the Engineer's Estimate.

Another step toward a highway into Death Valley was completed.

The following statistics of curvature and length afford a graphic picture between the old and the new:

Present	245	12,065° 00'00"	30	19.900	
Proposed	72	4,111° 48'20"	200'	17.541	
Difference	173	8,953° 11'40"		2.359	

Indications that as many as 100,000 new house trailers will be produced in the United States during 1937 are contained in reports received from various sources in the trailer industry.

Motor trucks in use in the United States last year numbered approximately 4,020,000.

Maze Road Proves Aid to Tracy and Modesto Traffic

(Continued from page 17)

the first contract stopped at the River Road, about 2½ miles short of the West Side Highway.

DISTANCE IS SHORTENED

This new cross-valley road westerly from Modesto, and using the existing West Side Highway into Tracy, will shorten the distance between Modesto and Tracy about one mile, as compared with the present State highway from Modesto through Salida, Ripon and Manteca to Tracy. There will be a considerable saving in time due to the new road avoiding all cities and built-up areas. A change in the West Side Highway east of Tracy would save another one and one-half miles.

The first contract included building a bridge over the San Joaquin River and grading and oil mix surface treatment of about 3.1 miles, between River Road and two miles west of Gates Road. This bridge has a total length of 1573 feet 7¾ inches and consists of two steel truss spans at 135 feet 3 inches each over the main channel and sixty-eight 19-foot trestle spans, sixty-three east of and five west of the Main Channel.

The steel spans are supported on concrete piers founded on wooden piling. All trestle piles are creosoted. The deck is concrete, 24 inches between guard rails. There is a two-foot walk on each side of the structure.

This contract was completed by the Pacific Bridge Co. The contract price was $162,973.50.

The second contract, let to Basich Bros. for a contract price of $46,285.80, consisted of grading and road mix surface treatment for about 4.7 miles of roadway. 1.85 miles lies east of and adjacent to the first job and 2.83 miles lies to the west; the westerly 1.39 miles is in San Joaquin County, the balance is in Stanislaus County.

This road should relieve to a considerable degree the traffic congestion on the present highway between Modesto and Tracy, and mean a considerable saving in time to traffic using it.

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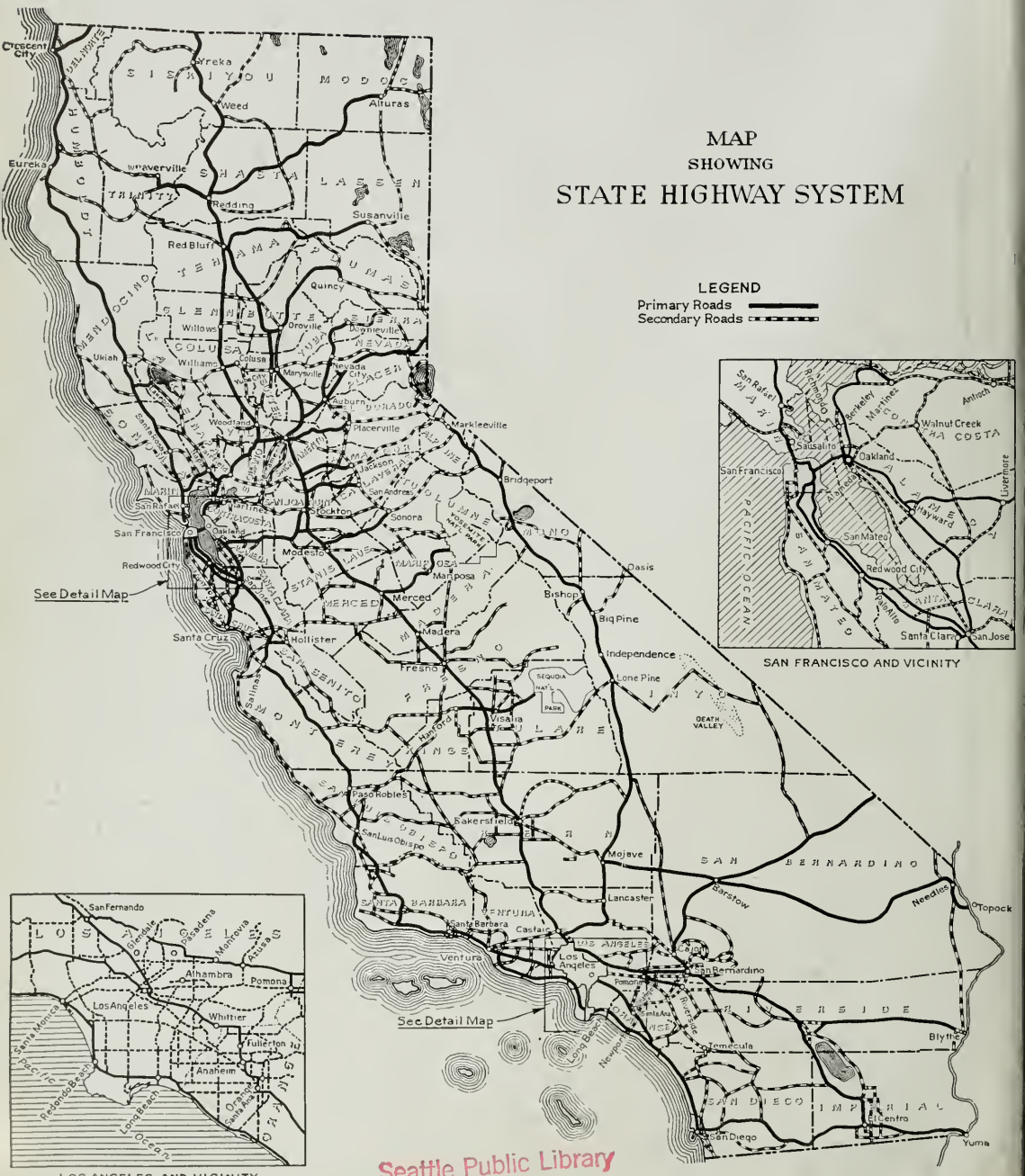
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Mountains and Stream form setting for Feather River Highway and its bridges

Official Journal of the Department of Public Works

AUGUST · 1937

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CALIFORNIA HIGHWAYS AND PUBLIC WORKS

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EARL LEE KELLY, Director | C. H. PURCELL, State Highway Engineer | JOHN W. HOWE, Editor

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Feather River Route Opens

By F. W. HASELWOOD
District Engineer

CARVED out of solid rock, hewn through granite cliffs, crisscrossing mountain streams, the eight million dollar Feather River Highway, State sign route No. 24, was dedicated to public service by Governor Frank F. Merriam with impressive ceremonies held in the shadow of Grizzly Dome in the canyon of Rio de las Plumas on August 14.

First surveyed for a wagon road by the pioneer engineer Arthur Walter Keddie in 1867, the Feather River Highway, a dream of seventy years, built at a cost of $100,000 a mile, is a reality.

California and Nevada, the counties of Butte and Plumas and many sections of the State represented by officials and the California State Chamber of Commerce participated in a three-day celebration in observanee of the opening of this splendid new highway, one of the most pieturesque in the west.

CHIEF WINNEMUCCA ATTENDS

A banquet and dance at Oroville on Friday night, August 13, eolorful dedieation ceremonies the following morning at Grizzly Dome, an outdoor luncheon tendered to Governor Merriam and his party and representatives of Governor Richard Kirman of Nevada and the Reno Chamber of Commeree at Quincy Saturday noon, followed by a program of speech making, and a banquet in Reno Saturday night featured the highway jubilee, which closed with a rodeo at Portola on Sunday.

To the dedication at Grizzly Dome eame Chief Winnemucca, sole surviving chieftan of the Piute tribe of Indians, who once ruled the wilderness domain through which runs the Feather River Highway. With Winnemueca were the boys' band of the Carson City Indian School in Nevada, and braves, squaws and papooses of the tribe, representatives of a vanishing nation of redmen.

SMOKE PIPE OF PEACE

The chief and his people camped on the highway at Grizzly Dome and after Governor Merriam, Director of Public Works Earl Lee Kelly and State Highway Engineer Robert A. Allen of Nevada had made short dedicatory talks, Governor Merriam left the speakers' platform, went to the tepee of Chief Winnemucca and there smoked a pipe of peace with the aged chieftan, signalizing the Indians' recognition of the march of progress of their white brothers.

In his talk, Governor Merriam praised the engineers of the Division of Highways who built the road and dwelt upon the magnitude of the task they tackled. Director Kelly took occasion to pay tribntes to Bert B. Meek, former Director of Public Works, under whose supervision the actual construction of the highway was launehed, and to Attorney General U. S. Webb, whose wise legal decisions made it possible to start the work of building the road.

To Fred C. Tatton of the California State Chamber of Commerce; Erie Cullenward, Publieity Director, and to Chairman L. B. O'Rourke and the members of the general committee in charge of the celebration is due credit for the successful and unusual ceremonies attending dedication of the new highway.



Delightful stretch of Feather River Highway approaching Storrie Creek Bridge.



BEFORE

This picture shows start of highway tunnel operations on face of Grizzly Dome, huge granite pile, in Feather River Canyon.

ANOTHER GREAT HIGHWAY

The dedication and formal opening of the Feather River highway signalized the completion of another of California's truly great highway projects.

This highway opens the door to another phase of development for the mountain area that it will serve and brings to reality the dreams long cherished by residents of Plumas County for closer contact with their neighbors in the great Central Valley. It marks the fulfillment of the mandate of the people as expressed at the polls in 1909, when $18,000,000 was voted to lay out and begin construction on the State's great highway system.

The Oroville-Quiney county seat lateral, or Feather River highway, follows the Feather River and its tributaries for 77.75 miles. The portion completed and now dedicated to public service is 70.75 miles between Oroville and Keddie. It was necessary to complete this entire unit before through traffic could be served. The seven miles between Keddie and Quiney is traversed by a usable road that is yet to be developed into a standard highway.

ELIMINATES OLD ROADS

Plumas County, like other mountain counties of California, rich in mineral deposits and timber, and with fertile valleys and abundant water supply, was settled early in the history of the State and was served by the usual narrow and crooked mountain roads over which the six- or eight-horse freight wagons slowly moved. These were mostly one-way roads even for wagons, and it is recalled that no longer ago than 1903, not far out of Beckwourth, our survey line wagon had to be let over the grade to permit a freight wagon to pass.

This survey was for the Western Pacific railroad which came into the county over Beckwourth Pass, followed the Middle Fork to Spring Garden and the North Fork to Oroville, breaking through for the first time, the commercial isolation of the county and opening the way for development of the natural resources.

Railroad operation began in the same year that the people of California decided that a system of improved highways was necessary to provide for the growing demands of the new type of traffic resulting from

the phenomenal development and use of the motor vehicle.

PLUMAS COUNTY INSISTENT

But the narrow wagon roads of Plumas County were of little or no use to the motor vehicle, and as this type of traffic rapidly developed, Plumas County again relapsed into a state of comparative isolation. Its people were never quiescent, however, but always firmly and respectfully demanded their birthright. And highway commissions consistently, but without sufficient funds, tried to do something about it.

A highway between Oroville and Quincy, fulfilling the mandate of the constitution for connecting county seats to the main trunk highways, if constructed along the Feather River or any of its tributaries, would cost more than contemplated by any financing provided for highway work and would be of no value unless entirely completed.

MERRIMAC GRADE TACKLED

Along about 1918, however, a proposal was under way to start construction on this highway following, in general, the existing ridge route by way of Bidwells Bar, Berry Creek, Merrimac, Letter Box, Bucks Ranch, Tollgate and Meadow Valley. This route has been the principal road serving Plumas County and since 1926 has been maintained by the State, serving as a detour during the construction of the river road. Surveys were started in the vicinity of Merrimac, and preparations were made for the establishment of a convict camp whose first work would be the development of a new route to eliminate the steep and difficult Merrimac grade.

Before this camp was established, the new $40,000,000 bond issue of 1919 was launched with the intent of its supporters that the Oroville-Quincy county seat lateral should be a low level road along the Feather River and its tributaries, with particular emphasis on the North Fork as *the* tributary.

"NORTH FORK OR NOTHING"

Plumas County wanted her isolation broken by an adequate highway and was never in doubt as to where she wanted that highway. The ridge road was closed by snow half of the year, and snow removal was not yet current practice. The divide crossed by this road at Letter Box, at the top



AFTER

And this picture shows how Division of Highway engineers conquered Grizzly Dome and pierced it with a tunnel and highway.

of Frenchman's Hill, was over 5800 feet high, and snowfall was heavy, came early and stayed late. Around Letter Box are axe marks high in the trees, said to have been made by mail carriers on skis. Plumas County didn't want its highway to be built over the ridge, and, in preparation for the 1940 bond issue, developed the slogan "North Fork or Nothing." But at no time was anyone ever misled into thinking that "nothing" would be acceptable.

Surveys via the North Fork were started in 1919, and the impossibility of constructing the road with funds that could be made available was immediately obvious. An estimate for the completed road made in 1924 placed the cost at $7,938,333.

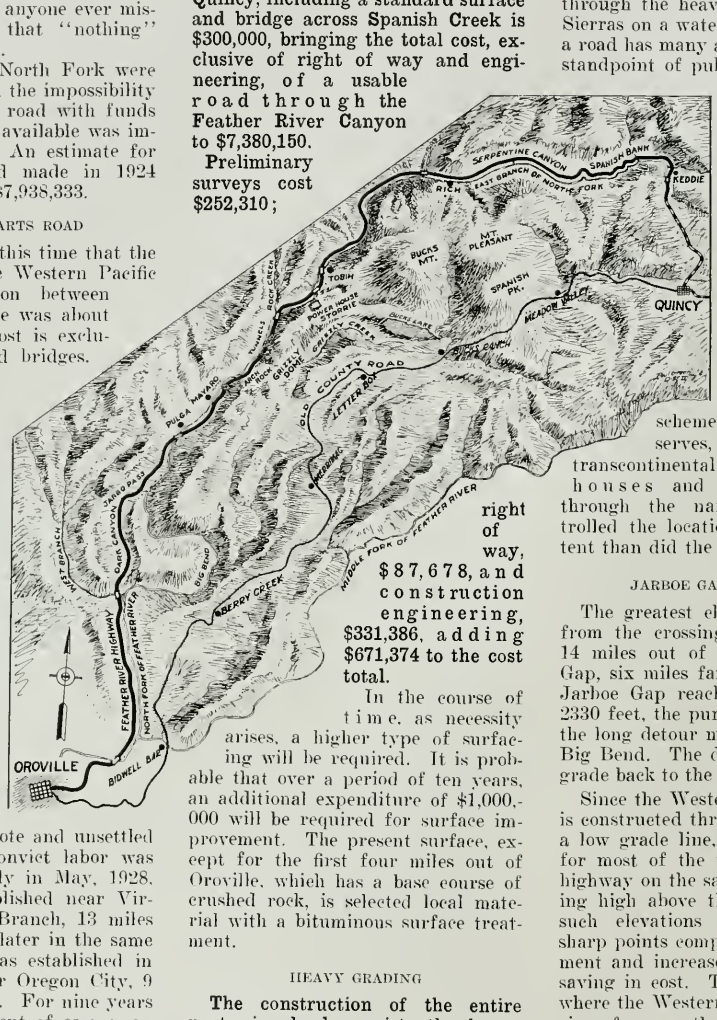
GAS TAX STARTS ROAD

It was known at this time that the cost of grading the Western Pacific through the canyon between Keddie and Oroville was about $7,616,000. This cost is exclusive of tunnels and bridges. The advent of the gas tax in making possible a continuous supply of funds provided the opportunity to start work on this road. New estimates submitted after further studies in 1927, placed the cost at $6,890,046, and a reasonable period of construction, if finances could be provided at a sufficient rate, as six years. The figures given are for net construction costs.

For a long-continued job in a remote and unsettled area, the use of convict labor was advantageous. Early in May, 1928, Camp 16 was established near Virgilia, on the East Branch, 13 miles below Keddie, and, later in the same month, Camp 17 was established in Potters Ravine, near Oregon City, 9 miles above Oroville. For nine years after the establishment of camps, an average of $800,000 per year or $2,700 per working day, has been expended by convict labor and by contract for grading, constructing bridges and for providing a temporary oiled surface on 70.75 miles between Oroville and Keddie.

COST IS $7,380,150

The net construction cost of the 70.75 miles dedicated to public use on August 14 is $7,080,150, or slightly over $100,000 per mile. The estimated cost of the remaining seven miles between Keddie and Quincy, including a standard surface and bridge across Spanish Creek is $300,000, bringing the total cost, exclusive of right of way and engineering, of a usable road through the Feather River Canyon to $7,380,150. Preliminary surveys cost $252,310; right of way, $87,678, and construction engineering, $331,386, adding $671,374 to the cost total.



In the course of time, as necessity arises, a higher type of surfacing will be required. It is probable that over a period of ten years, an additional expenditure of $1,000,000 will be required for surface improvement. The present surface, except for the first four miles out of Oroville, which has a base course of crushed rock, is selected local material with a bituminous surface treatment.

HEAVY GRADING

The construction of the entire route involved consistently heavy grading. The total excavation was 7,709,744 cubic yards, an average of about 109,000 cubic yards per mile. And most of the excavation, at least 85 per cent, was solid rock. Somewhat consistent with the formations encountered in any cross-section of the Sierras, there were belts of porphyry, diabase, granite, serpentine and schist. Except for portions of the latter formation, all of the rock was hard.

The Feather River highway is the only transmountain road that cuts through the heavy snow area of the Sierras on a water level grade. Such a road has many advantages from the standpoint of public service, but low initial cost or speed of construction are not among them. In construction through a river canyon, advantages in alignment, as well as in serviceability and cost, are usually secured by keeping the grade as close to the highwater as practicable. Possible though doubtful water storage schemes, Federal power reserves, the existence of a transcontinental railroad, power houses and transmission lines through the narrow canyon, controlled the location to a greater extent than did the rugged topography.

JARBOE GAP ELEVATION

The greatest climb on the road is from the crossing of West Branch, 14 miles out of Oroville, to Jarboe Gap, six miles farther. The road at Jarboe Gap reaches an elevation of 2330 feet, the purpose being to avoid the long detour made by the river at Big Bend. The descent is on a light grade back to the river at Pulga.

Since the Western Pacific Railroad is constructed through the canyon on a low grade line, it is impracticable for most of the way to construct a highway on the same side without being high above the railroad, and at such elevations deep ravines and sharp points compel a tortuous alignment and increased distance without saving in cost. Therefore, at Pulga, where the Western Pacific crosses the river from south to north, the highway reverses and, with a steel arch bridge located directly over the railroad bridge, crosses to the south side. The total length of the Pulga bridge is 680 feet. The central arch is 350



As illustrated on the cover page of this issue of CALIFORNIA HIGHWAYS AND PUBLIC WORKS, bridges "leap frog" on the Feather River Highway. Here, upper picture, the highway bridge at Tobin is underneath the Western Pacific bridge. Lower left—Section of scenic route between Storrie Bridge and Rock Creek Bridge. Lower right—Highway as seen from west portal of tunnel through Grizzly Dome.

feet long, and the grade is 216 feet above the river.

FOLLOWS RIVER FORTY MILES

Beyond the Pulga bridge, the road follows the south bank of the river not too far above the water and justifies its classification as a river road. For 40 miles it follows the North Fork and its tributaries as close to the river as topography and other controls will permit.

This proximity to the river offers the advantage of better alignment, more attractive scenery and cheaper construction, because fills of blocky rock can safely encroach on the river channel. The canyon walls are steeper, and polished areas of bare granite are encountered. The rocky walls of the canyon appear so firm and enduring that one can readily believe that they have changed but little since the beginning of time.

Geologists, who tell us differently, divide the past into ages measured in terms of millions of years and read in the rock formation, a different story. During one of these geological ages, a mighty river flowed southerly across the area that is now the western slope of the Sierras. The processes of nature leached the gold out of the granite and deposited it in crevices with solutions that crystalized into quartz.

WORK OF AGES

Through millions of years of weathering and by the aid of the river current, the softer rock was worn down and carried away, and the heavier quartz particles carrying gold were rounded and polished and deposited in the immense gravel bars that later became the mecca for the gold seekers who were California's early settlers. Then an upheaval disturbed the course of this river, and a great mass of ice covered the earth.

Glaciers moving westerly carved great gashes through the solid rock, and in these depressions flowed the streams originating in the higher mountains and discharging into the Sacramento and San Joaquin rivers.

Temperature changes resulting in contraction and expansions of the surface layers and the action of wind, water and frost disturbed most of the polished slopes left by the glaciers.

The Arch Rock and Grizzly Dome areas of the North Fork Canyon have most effectively resisted these forces of disintegration.

Arch Rock derives its name from a large, arch-shaped piece of the outer layer of the bare granite slope. Below the arch, the layer had fallen into the river and had disintegrated and been washed away long before anyone ever saw the canyon.

Strange to say, the original arch fell into the river of its own accord one night after the drill crew working underneach it, had gone home. Had the slip occurred a few hours sooner, more than the tools would have been lost. The same arch effect, however, is preserved in the remaining slab above the original arch.

GRIZZLY DOME

Grizzly Dome is higher, steeper and apparently sounder than the Arch Rock area. It is capped by a high, rounded mass of granite known as Elephant Butte. Faith in the apparent soundness of Grizzly Dome was shattered in 1935, before any construction work was started near the dome, by the spalling of a slab of rock from the front of Elephant Butte. Falling over 500 feet and crumbling as it fell, this 75,000 cubic yard mass of rock filled the river for a depth of 30 feet and a length of about 500 feet.

These more precipitous areas through the rugged canyon with its steep and bare granite walls, presented some rather formidable problems of design. Many alternate locations were investigated, and innumerable methods and types of construction were studied before the present low level location with three tunnels was adopted.

For ten miles between Pulga and Rock Creek, the road follows a niche cut in the solid walls of the canyon with three tunnels through precipitous, projecting points. Tunnel No. 1 is 265 feet long, 31 feet wide and 21 feet high, without lining. These dimensions contemplate lining which is not believed to be necessary at this time. To eliminate the hazard from falling rocks, rubble masonry portals were built on this tunnel.

TUNNELS REQUIRED

At one time the plans contemplated two short tunnels through projecting granite points in the two miles between tunnel No. 1 and Grizzly Creek. These points, however, proved to be loose, blocky formations rather than solid, and unsuitable for tunneling.

Grizzly Creek, the major tributary of the river from the south, after a precipitous drop from the high elevation near Frenchman's Hill, enters the North Fork at the base of Grizzly Dome. In the period of melting snows, this stream carries a large flow. It is now conveyed through a projecting rock point in a drainage tunnel 14 feet wide and 25 feet deep, and the channel is filled with coarse, blocky granite. A considerable portion of the flow prefers the original channel and finds its way through the rock fill.

Beyond Grizzly Creek, Grizzly Dome rises high above the river, with slopes ranging from vertical to about 60 degrees with the horizontal. The dome is capped with a huge rounded mass of granite known as Elephant Butte from which a piece of the face spalled off, as previously described. The shattering of Elephant Butte also shattered any faith that may have existed in the possibility of constructing or maintaining a road on the surface of the area below the Butte, and in the matter of safety of the men during construction or of traffic after the road was built.

TUNNEL 1187 FEET LONG

Numerous plans from the practical to the fantastic for building a road through the Grizzly Bluff area were studied. As finished, the road enters a 390-foot unlined tunnel after crossing Grizzly Creek. A short distance beyond this tunnel, the sweep of broken rock from the Elephant Butte slide left the slope in too dangerous a condition to risk the construction of a road on the surface. Consequently, a third tunnel 1187 feet long was constructed under the dome. Four adits contributed to economy and speed of construction and provide light and ventilation.

Two miles above Grizzly Dome, the highway crosses the North Fork on a steel truss bridge just above the mouth of Rock Creek.

In spite of the problems involved in constructing a road on the same side of the river as the Western Pacific, they were less between Rock Creek and Storrie than those encountered on the other side, among which was the passing of the Feather River power house at Storrie. Just above the power house the road crosses back to the south side and a mile and a half beyond, at Tobin, crosses again and under the Western Pacific bridge simultaneously.



Portion of large crowd of celebrants gathered at portal of Grizzly Dome tunnel to participate in dedication of Feather River Highway—Insert—Governor Merriam, Director of Public Works Earl Lee Kelly and Chief Winnemucca conclude ceremony of smoking pipe of peace.

HARD ROUTE TO KEDDIE

Twenty-seven miles more of continuously heavy construction through formations of granite, schist and serpentine, lead to Keddie. Just before Keddie is reached the highway crosses Spanish Creek on a high, steel viaduct and plays hide and seek with the Western Pacific railroad, crossing back and forth over the railroad tunnels.

During construction the camps moved ahead as the work progressed. Each camp occupied three locations during the nine-year construction period. Construction by convict labor covered a total length of 55.27 miles, of which the net construction cost was $4,886,610. Included in this was one bridge across Indian Creek, which cost $38,000, and three tunnels aggregating 1,742 feet in length, constructed at a net cost of $175,342. There were 48,772 cubic yards of tunnel excavation moved at a cost of $3.60 per cubic yard. The day labor work included 6,234,700 cubic yards of excavation.

There were six grading contracts for constructing 14.7 miles of road, involving among other items, the movement of 1,475,044 cubic yards and an aggregate cost of $1,305,206. There were also eleven contracts for bridges aggregating 0.78 miles. Total construction cost of these bridges was $775,334.

No discussion of this road would be complete without a tribute to the construction organizations of the camps directed by Superintendents Ed Rawson, W. B. Stout and Harry Waste.

Starting with an experienced crew as a nucleus, new men were trained as the work progressed and expanded. It is safe to say that no more efficient construction organization can be found in the country than the one which, after nine years of development, recently moved from Camp 30 to Southern California.

DREAM COMES TRUE

During the nine-year construction period, many engineers have had responsible charge of different phases of the work. At the conclusion of the work by the convict camps, R. E. Ward was resident engineer at Camp 28 and George M. Webb at Camp 30. P. R. Lowden maintained close contact between the camps and the district office.

For the people of Plumas County this completion of the Feather River highway is a dream come true. For the engineers it is the completion of a task, the magnitude and complexity of which is rarely encountered. For the people of California the Feather River highway, to which they have long looked forward as a link in a magnificent highway system, is a reality and forevermore an instrument of increasing service.

A TRIBUTE

"I would like to pay a tribute to the American road engineer. I think he has done a more beautiful and more durable job of road building than any road engineers who have ever lived. No one can look at one of the modern bridges, travel over the wide curves of one of the modern roads without marveling at the efficiency and beauty of the work. I am hoping that the same genius which the road engineers have lavished on our main highways will be displayed in terms of service although perhaps in a less striking manner to the eye on our *secondary highways."*— *Henry A. Wallace, U. S. Secretary of Agriculture.*

Largest Earth and Rock Fill Dam Dedicated by Governor Merriam

By EDWARD HYATT, State Engineer

MARKING the completion of the largest earth and rock fill dam of its type in the world, San Gabriel Dam No. 1—constructed by the Los Angeles County Flood Control District at a cost of approximately $17,000,000—was dedicated on July 21, 1937, at impressive ceremonies attended by over 2500 distinguished guests and citizens. Governor Frank F. Merriam gave the signal sending the last load of earth and rock into the dam, and was the principal speaker at the dedicatory exercises.

"**This is a happy occasion for all of the people of Los Angeles County and particularly for those in the plains below the mouth of this great canyon,**" said Governor Merriam. "**San Gabriel Dam is a tribute to the broad vision of those who built it. It is a monument to those who supported it. It not only harnesses a menace to the residents of the valley below, but provides a tremendous resource in water during the arid seasons. It is dedicated to foresight and thrift. May I congratulate those who started this great project, those who carried on and those who completed it.**"

SPEAKERS LAUD PROJECT

With Vice President W. S. Rosecrans of the Los Angeles Chamber of Commerce acting as master of ceremonies, the program was broadcast by radio. The speaker's stand, erected on the crest of the towering structure, was packed with distinguished guests, including present and former members of the Los Angeles County Board of Supervisors, Federal and State officials, and civic leaders.

Other speakers in addition to Governor Merriam included Supervisors Roger W. Jessup, Chairman of Board; Herbert C. Legg, Chairman, Flood Control Committee; Gordon L. McDonough, Leland M. Ford and John Anson Ford; Byron C. Hanna, President, Los Angeles Chamber of Commerce; J. Louis Matthews, Editor, Covina Argus and often referred to as the "Father of flood control in San Gabriel Valley"; H. S. Gilman, President, Conservation Association of Los Angeles County; Marshall R. Bowen, President of the San Gabriel Valley Protective Association; Major Theodore Wyman, Jr., of the United States Army Engineers in Charge of Federal Flood Control Projects in Los Angeles County; Earl B. Backman, representing S. B. Show, Regional Forester; E. T. Foley, official of the Western Slope Construction Company, builders of the dam; C. H. Howell, Chief Engineer of Los Angeles County Flood Control District; and Edward Hyatt, State Engineer.

All who spoke joined in landing the project and paying well-deserved tribute alike to civic leaders, county officials, engineers, contractors and the army of workmen whose combined efforts were responsible for its successful consummation.

BUILT BY FLOOD CONTROL DISTRICT

San Gabriel Dam No. 1 is the most recent and largest of nineteen flood control and conservation dams built by the Los Angeles County Flood Control District. This District was created by an act of the State Legislature passed on June 12, 1935. As a result of extended investigations, a plan for flood control and water conservation was adopted by the District, and construction was started in 1918. Work has proceeded almost continuously since that time but with revisions in and additions to the original plan.

The dam is located in the lower mountain reaches of San Gabriel River about 3 miles below the junction of the West Fork with the main stream and about 9 miles upstream from the city of Azusa.

This dam on the San Gabriel River will serve the dual purpose of controlling floods and conserving flood waters which would otherwise flow unused to the ocean. This stream is the largest in Los Angeles County. It rises in the San Gabriel Mountains with many branches, the chief of which is the West Fork which joins the main stream about 3 miles above the location of San Gabriel Dam No. 1. Below these forks the river flows through a deep gorge and enters the San Gabriel Valley at a point near the city of Azusa. It has a mountain catchment area of 313 square miles, 205 square miles of which are above San Gabriel Dam No. 1. Upon leaving the mountains the stream flows in a southwesterly direction through the San Gabriel Valley and thence across the coastal plain to empty into the ocean near the city of Long Beach.

The stream is the main source of supply for the 278 square mile area of the San Gabriel Valley and for a portion of the coastal plain as well—an intensively developed and heavily populated region embracing scores of cities and towns and many thousands of acres of highly productive farm lands. When the stream is in flood, lands and improvements along its course from the mountains to the sea are subject to inundation, and have suffered serious flood damages in past years. The reservoirs created by the San Gabriel dams are to provide the necessary storage for controlling the floods and conserving the waters of this stream.

PROJECT LONG DELAYED

The historical background of San Gabriel Dam No. 1 is perhaps without parallel in any similar project. Although control of floods on the San Gabriel River was first urged over 40 years ago by J. L. Matthews, Editor of the Covina Argus, it was not until after the disastrous flood of 1914 occurred with damages estimated at $10,000,000 in Los Angeles County that sufficient impetus was gained to bring about the organization of the



Governor Frank F. Merriam gives signal for dumping of last truckload of rock at dedication of San Gabriel Dam. Left to right: Flood Control Engineer C. H. Howell, Supervisors Leland Ford, John A. Ford, Herbert C. Legg; E. T. Foley and W. A. Rogers, West Slope Construction Co., Supervisor Roger Jessup, Governor Merriam.

Los Angeles County Flood Control District and the active consideration of flood control plans for the San Gabriel River and other streams in the county.

Initially, disagreement arose as to the best plan of storage development on the San Gabriel River. There was a great diversity of opinion not only among the general public but also among recognized experts. Conflicts between many interests added to the confusion.

ORIGINAL PLANS ADOPTED IN 1924

The first plans for a dam on the San Gabriel River, prepared by the then Chief Engineer J. W. Reagan, were adopted by the District in 1924 and construction authorized with a bond issue voted that same year. A massive concrete dam was proposed to create a reservoir with a storage capacity of 240,000 acre-feet, involving an estimated cost of $25,000,000. The site chosen was the so-called "Forks Site" located immediately below the junction of the West Fork with the main stream.

Due to questions raised as to economic feasibility and safety of the proposed structure, no construction was started. Numerous investigations and reports by engineers and expert geologists were made during the next few years in an effort to settle the continued controversy as to location and design. E. C. Eaton replaced Mr. Reagan as Chief Engineer of the District in April, 1927. Following his appointment, plans were proposed for a smaller dam on which contract bids were actually received but rejected in 1927. Litigation ensued in the controversy of "high" versus "low" dam culminating in a decision of the Superior Court in March, 1928, enjoining the District from constructing a dam to store any less than 240,000 acre-feet.

CONTRACT LET IN 1928

Following this period of investigation and litigation, new plans and specifications were prepared and contract bids received in November 1928 for a concrete masonry dam at the Forks Site to provide a storage capacity of 240,000 acre-feet. Contract was awarded to Fisher, Ross, McDonald and Kalm and signed in December 1928.

Actual construction was started in March 1929, chiefly in the excavation of the west abutment. Weaknesses in the foundation rock at this site became apparent soon after excavation work started. Following the oc-

(Continued on page 21)

Improved Sherwin Hill Grade Increases Lure of High Sierra

By C. Cleman, District Maintenance Engineer

AFFORDING motorists a more attractive route into the recreational areas of Inyo and Mono counties, the Sherwin Grade improved alignment project has been completed by the State Division of Highways.

Traffic over this route has been constantly increasing for years due to the fact that it is the only road over which the beauty spots of the High Sierra, immediately to the north of Sherwin Hill, can be reached from Los Angeles and other cities in the southern part of California. It serves a section in which are located many beautiful lakes and streams where camping, fishing, hunting and outdoor life can be enjoyed during the summer months and where skiing and snow sports provide winter pleasures.

Since the early mining days Sherwin Hill, which rises from the comparatively level lands of Owens Valley to the higher bench lands on the north, has been an obstruction to travel and transportation, which, to date, has not been satisfactorily overcome.

EARLY TOLL ROAD

About 1860 Mr. James L. C. Sherwin constructed a toll road up Sherwin Hill, which the present route of U. S. Highway No. 395 approximately parallels about one-half mile to the east, between the Inyo-Mono County line and the summit. At these points the location of the two routes converge.

The construction of the toll road was incident to the development of a large mining camp at Mammoth Mines, about 25 miles to the north, which at one time had a steady population of from four to five thousand people, increasing to as many as ten thousand for a few days at a time, it is estimated. Much heavy mining machinery was hauled over the road on horse drawn wagons in the first few years of its existence. This heavy traffic made a severe demand on the road constructed up the tuffa rock slopes, where the only other material for road building purposes consisted on fine sand. The result was that the road surface soon became very rough, consisting mostly of solid rock points and holes where the sandy filling had been washed out during rain storms, or cut out by the steel tired wagon wheels.

ACCIDENT PRODUCED RESULTS

One day a large fly-wheel, which was to be used in the construction of a mill, was being hauled up over this toll road. Twisting and bouncing over the rough, rocky, deeply rutted surface of the road was too severe a strain on the load fastenings so soon after having passed the summit and starting the descent into the Rock Creek Gorge along the road built on the steep hill side, the load shifted, tipped the wagon over, broke loose and rolled some five hundred feet to the bottom of the Gorge below. To retrieve this wheel was a difficult and expensive task at that time.

This event was the deciding factor with the mining interests, which depended upon the toll road for transportation to their mines and were the most constant users of the road. They immediately initiated the construction of a road known as the "Dry Road" which was routed up the Sherwin Hill slope to the east of the Rock Creek Gorge. This road and the Sherwin toll road were in competition for favor of the traveling public for about twenty years. The "Dry Road" was favored by the mining interests while the Sherwin toll road had the patronage, for the most part, of others. The tolls were abandoned on Sherwin road about 1885.

HARD ON EARLY MOTORISTS

The first automobiles over Sherwin Hill followed the toll road; however, due to the projecting rocks and deep ruts on the steep grades, this was a difficult trip to make and motorists soon adopted the use together with the balance of Highway Route 23 in Mono County, South of Bridgeport, of the Dry Road and this road was taken into the State Highway system, by the State Highway Act of 1909.

In the early days of the automobile, to drive up Sherwin Hill was a difficult feat, especially during hot weather. It was the practice in those days to drive to the foot of the grade, about fourteen miles north of Bishop, and camp for the night. An early start would then be made the next morning to make the drive up the five mile grade, rising in elevation about two thousand feet in this distance, before sunrise. Even at the present time with an improved highway and more powerful automobiles, it is desirable, on a hot summer day, to make this climb before 11 o'clock in the morning, as usually after this hour there is a warm breeze blowing up the grade from the south. On any summer day it is not unusual to find one or more heavily laden trucks and automobiles stalled due to overheating of motors and fuel pumps.

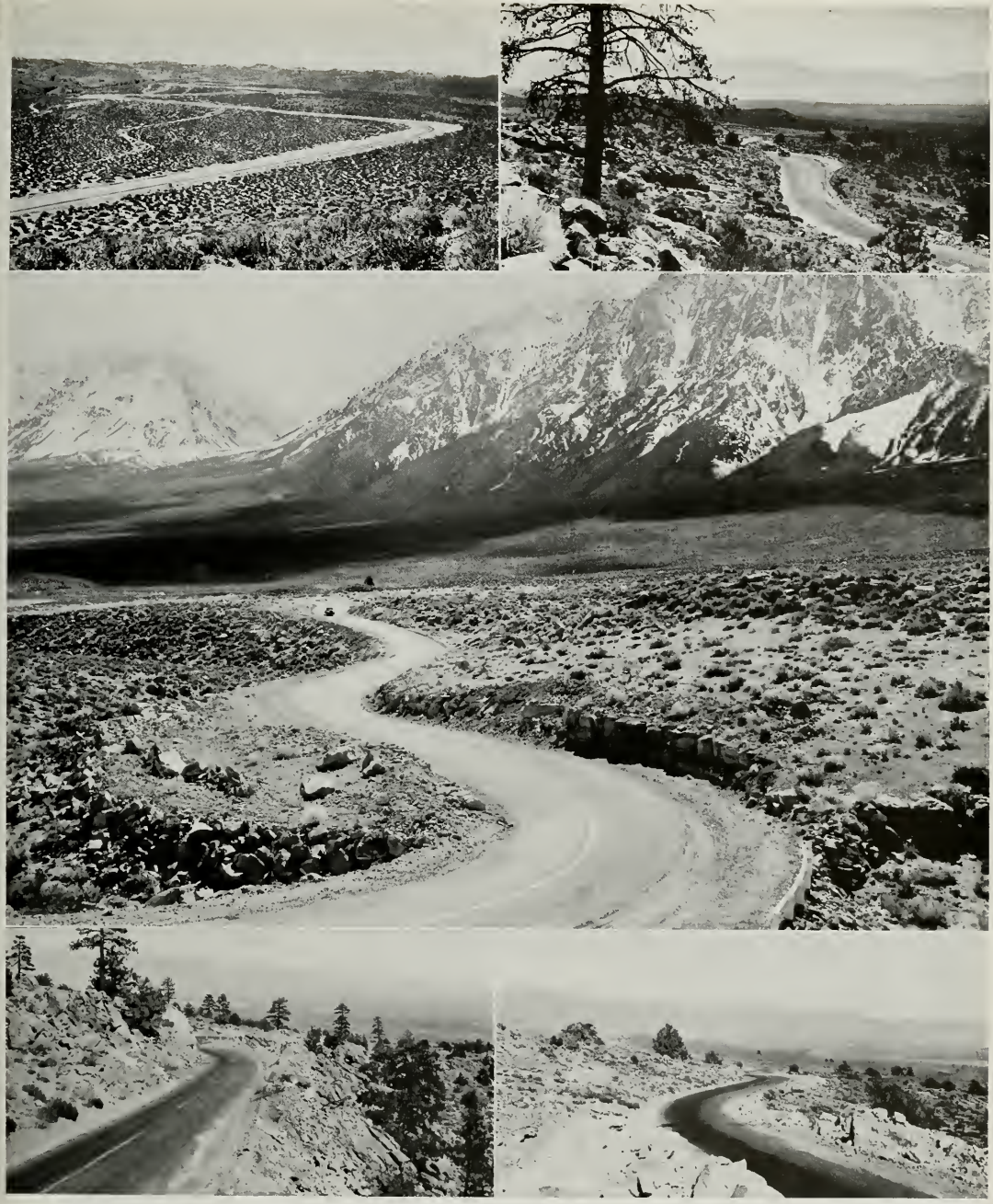
In view of the unsuitability of both the Sherwin Toll Road and the Dry Road, the State located the present highway in 1914, on which the construction by State forces was completed in 1917, at a cost of $45,140. This road remained with only a dirt surface until 1928, when an application of light fuel oil was spread on the roadbed as a dust palliative.

INCREASE IN TRAFFIC

The increase in automobile traffic over Sherwin Hill, which made the oiling necessary, resulted from the improvement of the roads leading from the populous southern part of the State. This increase in traffic has also made it imperative, for safety and convenience, that the alignment of the grade constructed between 1914 and 1917 be straightened, the roadbed widened and the surface improved.

The highway as originally constructed, having a sixteen-foot roadbed, and no grade over eight per cent, followed somewhat closely the contour of the face of the hill, going out

(Continued on page 29)



Curves are doomed on Sherwin Grade. Upper left—Looking north from a point 3 miles south of Sherwin Hill Summit showing the switchback alignment up Sherwin Hill at this point. Upper right—Looking south from Sherwin Hill showing curves which will be eliminated. Center—Looking south from Sherwin Hill into Round Valley. Lower left—This curve and one on right are being realigned out of Sherwin Grade.

Award of Contract Dooms 59 Bad Curves on Cuesta Grade

By LESTER H. GIBSON, District Engineer

CUESTA GRADE on the Coast Highway (U. S. 101), with its seventy-one hazardous curves, is doomed.

Reconstruction of this dangerous section of the coast route between San Francisco and Los Angeles has been launched with the awarding by the State Department of Public Works of a contract for $646,027.90 for the proposed improvement.

A modern four-lane divided roadway will replace the existing winding Cuesta Grade highway. Built in 1915, improved in 1923, the present road, although adequate at the time it was constructed and for some years thereafter, is too lacking in modern day standards to satisfy the requirements of the larger, heavier and faster traffic that has developed. Due to limited sight distance, fast traffic often has to maintain the speed of slow-moving trucks. This creates an extreme hazard because of the impatience of some drivers who are too prone to take a chance in passing vehicles ahead.

TORTUOUS ALIGNMENT

Cuesta Grade is just north of the city of San Luis Obispo, in San Luis Obispo County. This project is 3.282 miles long and will be 0.72 mile shorter than the present highway between the same termini.

With the opening, in early May of this year, of the new Conejo Grade, in Ventura County, Cuesta Grade remains the only stretch on U. S. 101 between Los Angeles and San Francisco where traffic is required to traverse a combination of tortuous alignment, mountain grade and narrow roadbed.

Early in 1936 the District V staff of the Division of Highways began the job of preparing plans for reconstructing Cuesta Grade on standards consistent with the present day requirements. Exhaustive preliminary studies showed the side of canyon traversed by the present road to be the best suited for the type of highway proposed.

SUBSOIL SURVEY MADE

From experience in the past years maintaining the existing road it was evident that some of the terrain, over which the project would pass, was of an unstable nature. This, together with a pretty comprehensive idea of the magnitude of some of the required cuts and fills, made it pertinent that we know a great deal more about the underlying soil conditions than could possibly be determined from surface indications. At a conference with the department heads in Sacramento it was decided to make a complete subsoil survey over the entire project.

The Central Office Laboratory immediately sent a crew of testing engineers, equipped with a power well drilling rig, hand soil testing apparatus and an electrical resistivity sounding device, to make this survey. It is believed this is the first time the electrical device has ever been utilized for shallow depth tests. The findings of this device were verified by tests made with the well drilling rig and later by tests made by the Bureau of Public Roads' engineers using a seismographic testing apparatus.

SOIL SURVEYS JUSTIFIED

This work was done under the direct supervision of Mr. O. J. Porter, Associate Testing Engineer, connected with our Central Office Testing Laboratory. Mr. Porter was in responsible charge in connection with the testing work for the foundations of the San Francisco Bay Bridge. His work on Cuesta Grade was well planned and well executed. The cost, comparatively speaking, and considering the benefits derived, was nominal.

This type of soil survey will probably become a regular part of the preliminary studies in the future on highway projects where heavy work is anticipated. It should be stressed how important it was to determine the treatment necessary in unstable areas where heavy fills are proposed. In these areas it is planned to excavate transverse and in some cases additional longitudinal trenches, 10 feet in width, through the unstable material and backfill these for a minimum depth of 5 feet with broken rock, of various sizes, to serve as blind drains. In addition, an 8-inch perforated metal pipe is to be placed in the transverse trenches to accelerate drainage.

These tests were also important in determining the slopes to be used in cuts. At the summit cut, which is to be 30 feet deeper than at present, it is planned to use a $1\frac{1}{2}$:1 cut slope on the right side and a $1\frac{1}{4}$:1 cut slope on the left. Other cut slopes are to be 1:1 and $1\frac{1}{4}$:1. Conventional fill slopes will be used throughout.

PLANS TO HANDLE TRAFFIC

The new road will closely follow the existing road on a plane about twenty feet lower, except where it has been necessary to deviate in order to get proper alignment. This will make an interesting set up for those who travel it during the construction period, as it is now planned to keep traffic on the existing road, or at the same level, until the later stage of the actual dirt moving. The traveling public will have an opportunity to view the methods employed in constructing the roadbed of a modern highway.

Where the new construction is in conflict with the existing road, the existing road will be widened out to the new cut slopes and the excavation of the new road confined, in order to leave a detour bench at the level of the existing road. It naturally follows, this detour bench will be removed when a portion of the new road is constructed to grade and made usable for traffic. All detour roads will have a minimum width of 25 feet. There will be little interference with the movement of traffic except where it will be necessary to carry through construction at the summit.

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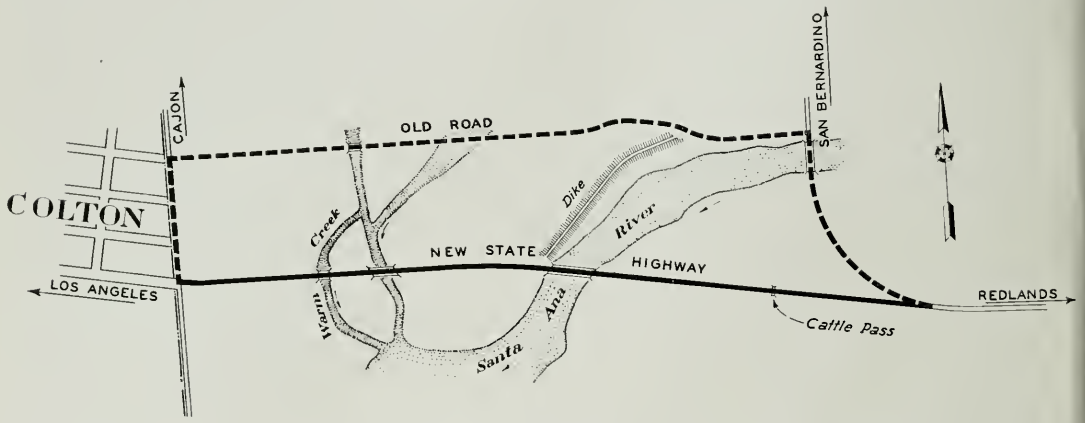
New Cuesta Grade in the making. Upper—Trucks excavating Summit Cut and hauling material down existing highway to fill north approach of overhead crossing Southern Pacific tracks. Center—Two tractors and master bulldozers and a roller pioneering one of fills. Lower—Leveling and compacting fill at north approach to proposed overhead crossing.

Highway Progress Puts End to Obsolete Road East of Colton

By E. Q. SULLIVAN, District Engineer

MAJOR construction activities have written "Finis" to an obsolete portion of the Los Angeles-Imperial Valley Highway east of Colton, commonly called the "Valley Boulevard," and replaced it with a modern standard highway on new location.

The new highway extends from the east city limit of Colton 1.3 miles easterly, to a point where the portion of State Highway connecting with South "E" Street, San Bernardino, intersects this highway in a long sweeping "Y."



This project, together with three others, the widening of I Street within the Colton city limits, the completion of Route 26 west of Colton, and completion of the South Eighth Street Underpass, Route 43, connecting Colton and Riverside, was dedicated by Governor Frank F. Merriam at ceremonies held in Colton July 28.

Participating in the dedication were Director of Public Works Earl Lee Kelly, Assistant Public Works Director Justus F. Craemer, Highway Commissioner Phil A. Stanton, Senator Ralph Swing of San Bernardino, Mayor Harford of Colton and mayors of surrounding cities, and State, county and city officials. City Attorney Waldo Willhoft was master of ceremonies at a banquet tendered to Governor Merriam.

The new highway just completed was the result of two contracts under way simultaneously. Under one contract, three bridges were constructed, one across Warm Creek, consisting of two spans of 54 feet each, the second bridge across an overflow channel consisting of four 50 foot spans and two 16 foot cantilever spans, the third across Santa Ana River consisting of six 61 foot spans and two 20 foot cantilever spans. In addition to these bridges, a cattle pass structure was built to provide for the free passage of domestic animals without interruption to traffic.

EROSION PREVENTION

Under the other contract, the highway, excepting the bridge portions, was constructed. This consisted of making an embankment across the low river-bottom land and constructing a protective dike along the northerly side of the Santa Ana River. Material for the dike and embankment was taken from the river channel.

In addition to paving and placing drainage structures, willow cuttings were planted in the surface of the southerly slope of the dike, and have already started a sturdy growth that will be instrumental in protecting the dike against erosion.

A forty-five foot width of asphaltic concrete pavement was placed on a seventy-six foot roadbed from Colton City limits to the Warm Creek Bridge. This conforms to the standard of the recent adjoining improvement through Colton.

From Warm Creek to the eastern terminus of this project a thirty foot width of Portland cement concrete pavement bordered with eight foot oil treated shoulders was constructed on a forty-six foot roadbed. The bridges were constructed to a clear roadway width of thirty-four feet, with a four foot sidewalk on each side.

THREE TRAFFIC LANES

This roadway bearing three traffic lanes, conforms to the pavement width of the section of highway extending easterly from this project to Redlands. It further conforms with the project included in the current budget to widen the existing two lanes

(Continued on page 29)



Views of newly completed Redlands-Colton Highway. Upper—New road pictured on left at junction of highway to San Bernardino. Center—Bridge on new highway across Warm Creek. Lower—Section of improved highway looking towards Colton.

Modern Highway Replaces Old Winding Jack Rabbit Trail

By A. EVERETT SMITH, Assistant Highway Engineer

THE Jack Rabbit Trail, noted for its twisting and winding alignment and its steep grades, is now entirely replaced for through traffic to Riverside by a new highway of modern standards, extending from Box Springs to Beaumont. The old Jack Rabbit Trail reverts to Riverside County and it will continue its long useful life as a connection for the lighter traffic to Hemet and San Jacinto.

For east bound traffic, the old road left the "Inland Route" at Alessandro, passed by March Field, and continued easterly through Moreno to the west slope of the Moreno Bad Lands. Here it skirted these irregular mountains in a southeasterly direction until a location was found, where with early day methods of construction a road could be pushed through the jagged peaks to Beaumont.

This section of the old Jack Rabbit Trail through the Bad Lands was very tortuous and perilous to traffic, with severe grades, steep slopes, and numerous sharp curves having short sight distance.

NEW HIGHWAY IN THREE LINKS

The new highway was constructed in three links as follows:

The first link was the carving of a modern highway through the Bad Lands. This feat was accomplished in 1935, resulting in a picturesque road with high cut slopes, deep fills, and gentle curves where cars glide through the broken mountains, as if in mockery to their once impregnable ruggedness.

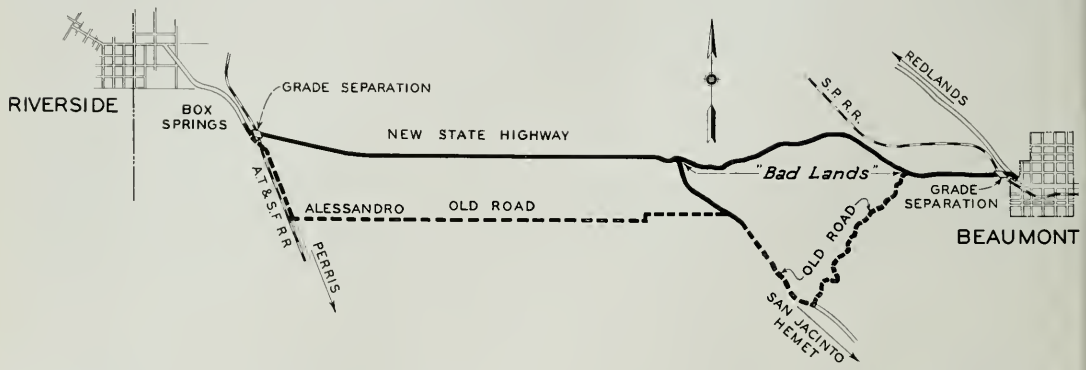
The second link lying to the west of the first was completed last May and extends from Box Springs to the Bad Lands. This section is featured by long tangents and a mild gradient. It crosses over the tracks of the Atchison, Topeka and Santa Fe Railway on a new overhead concrete structure at Box Springs completed in October, 1936, and extends easterly over the table land across the north side of the Moreno Valley.

The last link begins at the east side of the Bad Lands and extends easterly to Beaumont, where it connects with the heavily traveled State highway route 26 that carries a large volume of interstate and commercial traffic. This link crosses San Timoteo Creek on a concrete bridge and crosses over the Southern Pacific Railroad tracks on a new concrete structure, thus eliminating the old, inadequate, and dangerous overhead structure.

FIVE MAJOR CONTRACTS

The completion of this route was accomplished by five major contracts, one each for the three roadway links, and one for each of the grade separation projects. Under these five contracts, approximately 1,577,000 cubic yards of roadway excavation were made, 3,170 cubic yards of structure concrete were poured, and 18.55 miles of oil treated surfacing were placed. These projects also embody the construction of two reinforced concrete overhead grade separation structures, one reinforced concrete bridge, and various drainage structures and facilities to care for the "flash floods" from cloudbursts that are prevalent in this section.

Completion of the third link, early in July, gives the motorist a highway ample for modern high speed traffic. This highway will provide a vastly improved alignment, gradient, and riding quality. It will also provide a total net saving in distance of four miles between the cities of Riverside and Beaumont.

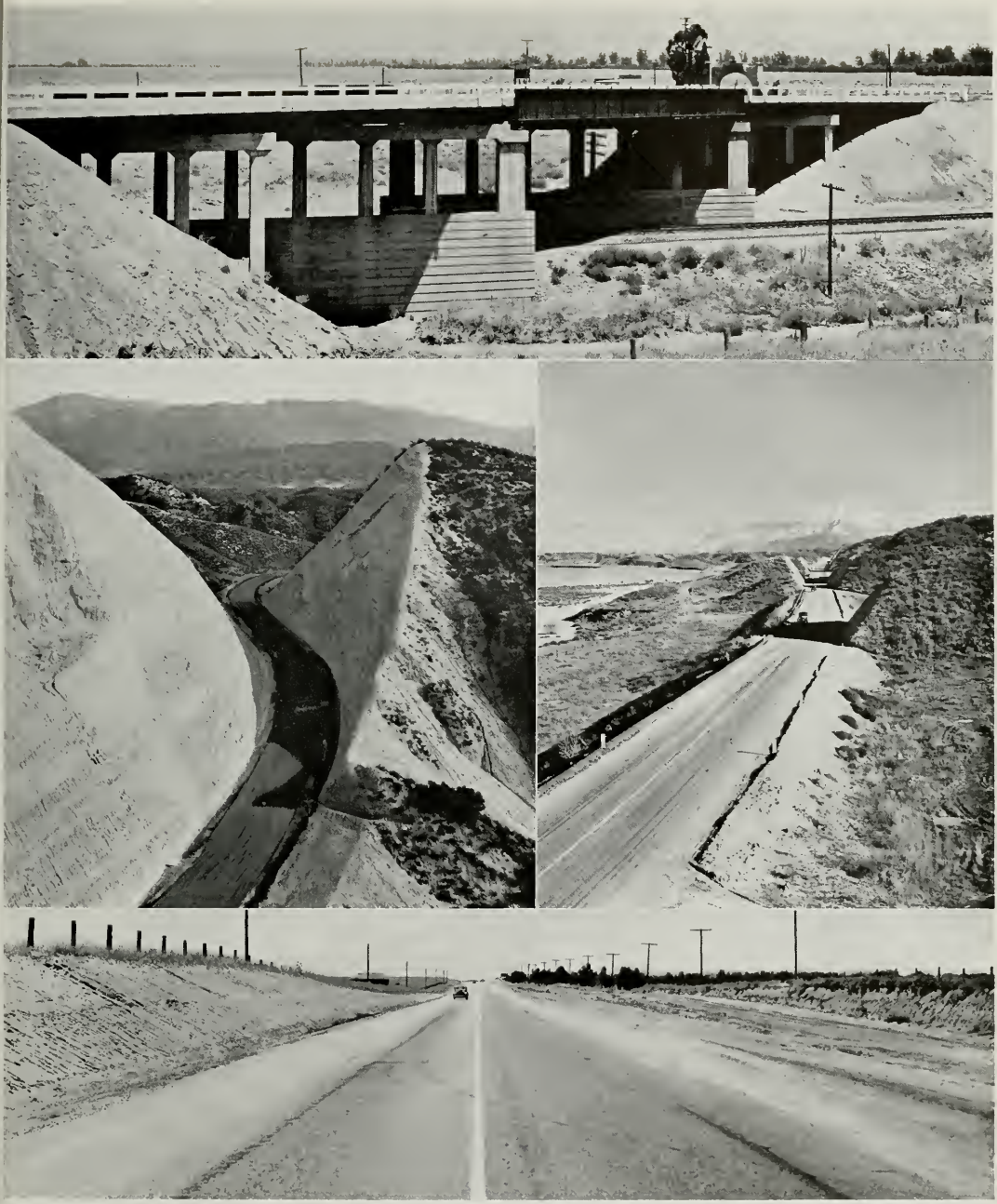


Angler: "You've been watching me for three hours. Why don't you try fishing yourself?"

Onlooker: "I ain't got the patience."

Beach Peach: "It must have taken a lot of courage to rescue me the way you did."

"Smiles" McGill: "You bet it did! I had to knock down three other sailors who wanted to do it."



What new jack rabbit trail looks like. Upper—Grade separation overhead at Box Springs near Beaumont. Center left—Deep cut on new highway looking towards Gorgonia Range. Center right—Another view looking towards Beaumont with Mt. San Jacinto in background. Lower—View of realigned highway west of Beaumont.

Traffic Flows While Highway Is Being Built

By R. M. GILLIS
District Engineer

A VERY much needed eight and four-tenths miles of three lane highway from Fresno north to Herndon on U. S Highway 99 was completed for public use in June, when the Division of Highways without formal celebration or ceremony accepted the second and final contract on this section.

This work, carried out under two contracts extending over a year's time and costing over $413,000, has given to the City of Fresno an adequate and modern approach on the north.

The old pavement on a sixty foot right of way, built fifteen feet wide twenty-four years ago and later widened to twenty feet, in addition to being badly broken was inadequate to properly handle the seven to ten thousand cars a day using this road.

NEW 30-FOOT PAVEMENT

The new thirty-foot pavement built on a ninety-foot right of way, follows the same alignment as the old road, but the new grade line has been entirely revised to insure proper drainage, eliminate bad dips in the old road, and contributes to safety by providing long sight distances.

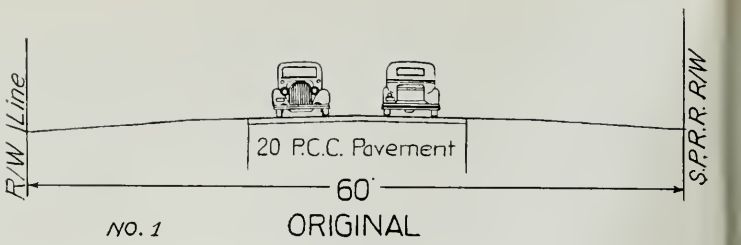
An added safety factor is offered by the contrasting colors of the three ten-foot pavement lanes; the two outside ten-foot strips are of Portland cement concrete while the center ten-foot passing lane is of black asphaltic concrete.

The major reason for the design chosen was the construction problem with which the Division of Highways was faced in planning this improvement.

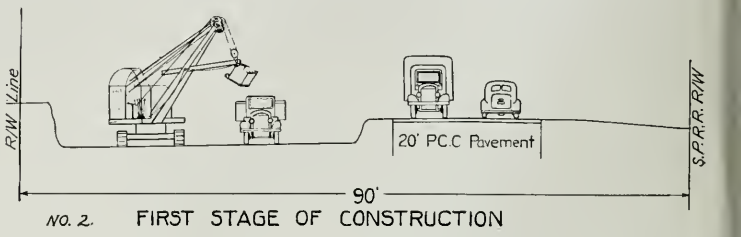
INNOVATION IN DETOURS

No satisfactory detour roads were available so that for the entire period of building a daily traffic averaging about eight thousand cars every twenty-four hours had to be carried through the construction work. This was accomplished satisfactorily and without serious accidents by taking one side of the road at a time, confining construction operations to that side and using the other side for traffic. The fact that the maximum cut for the new pavement was five feet below the old and the maximum fill was seven feet made this arrangement possible.

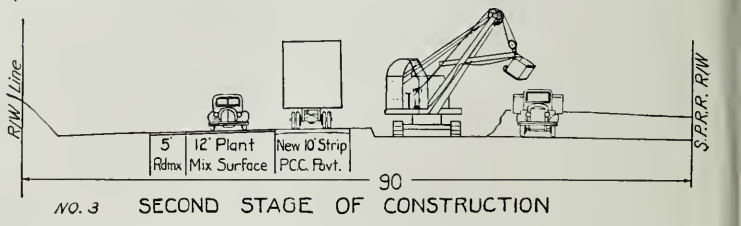
The method of construction is illustrated by the accompanying sketches. Credit for its successful operation in handling the heavy traffic without delays or inconvenience throughout the long period of construction is largely due to the efficiency and cooperation of the Hanrahan Company and the Union Paving Company, which were the contractors.



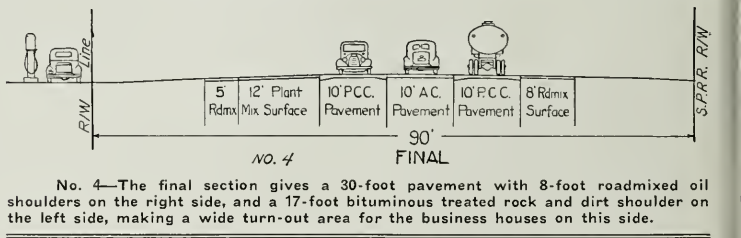
No. 1—The original road was a 20-foot pavement on a 60-foot right of way. The first step in improvement was to acquire 30 feet additional right of way to give a 90-foot width.



No. 2—Traffic was confined to old pavement on right hand side of roadway. The left side was brought to grade; the left 10-foot lane of Portland cement concrete pavement was constructed and with a 12' x 4" shoulder of bituminous treated rock, together with a 5-foot roadmixed oil shoulder, gave two traffic lanes for the next construction operation.



No. 3—Traffic was turned on completed left half of roadway, the right half was graded and the right 10 feet of Portland cement concrete placed. The final paving done was to fill in the 10-foot asphaltic concrete passing lane and finish the shoulders.



No. 4—The final section gives a 30-foot pavement with 8-foot roadmixed oil shoulders on the right side, and a 17-foot bituminous treated rock and dirt shoulder on the left side, making a wide turn-out area for the business houses on this side.



Upper picture shows newly improved section of Route 4 at the north boundary of the city of Fresno. An added safety factor is offered by contrasting colors of the three 10-foot pavement lanes. The two outside strips are of Portland cement concrete while the center passing lane is of black asphaltic concrete. Lower—Typical section of completed highway between Fresno and Herndon.

Construction Work on Altamont Pass Highway Project Launched

DESCRIBED by Edward J. Neron, Deputy Director of the Department of Public Works, as the "biggest dirt-moving job ever undertaken by the Division of Highways," the work of realigning Altamont Pass in Alameda County, eliminating 45 dangerous curves, was officially launched with ground-breaking ceremonies in the foothills at the eastern end of Livermore Valley on July 17.

Actual construction operations were started two days later and next September the new $1,260,000 highway will be dedicated to the public.

More than 1000 persons witnessed the ceremonies attending the start of the Altamont Pass project. Mrs. Neron, wife of the Deputy Director of Public Works, broke a bottle of Livermore Valley champagne against a huge steam shovel and Mr. Neron, who represented Governor Frank F. Merriam and Director of Public Works Earl Lee Kelly, was at the controls of the giant machine when it dug out the first scoop of earth, signalizing the starting of work.



Deputy Director of Public Works Edward J. Neron at controls of steam shovel which broke ground for new Altamont Pass project. Chairman William J. Hamilton of Alameda County Board of Supervisors beside him. Grouped in front of shovel are (left to right) County Surveyor Burnett Hamilton and Alameda Supervisors Thomas E. Caldecoit, George Janssen and George Hellwig.

SERIOUS TRAFFIC CONDITION

Dr. F. L. Herrick, president of the Livermore Chamber of Commerce, presided at the ceremonies. Mr. Neron was the principal speaker.

"Construction of this new highway on the main artery between San Francisco and Stockton and the upper San Joaquin Valley," Mr. Neron said, "climaxes an exhaustive study to relieve a serious traffic condition which is becoming more acute each year.

"Traffic during the past ten years has steadily increased. In 1926 a traffic count indicated a travel of 2600 vehicles daily. A similar count in 1936 showed a count of 9000 cars daily.

"It is interesting to note that in 1926 approximately 10% of the 2600 cars were trucks. In 1936 this average had increased to 20% with heavy units predominating—a ratio of about two to one.

"This condition, of course, has been brought about by volumes of San Joaquin Valley products shipped to the coast by trucks rather than by rail. These heavy trucks, with trailers of all sizes, necessarily travel slowly, going through the winding pass on the old two-lane roadbed. The faster cars, of course, are unable to pass, which has been largely responsible for terrific congestion practically continuously during the past few years.

"The old road from Livermore easterly is so situated that it became impracticable for the Division of Highways of the Department of Public Works to reconstruct short stretches, so it was decided at a meeting held by the Highway Commission in Oakland, California, in August, 1936, that this all important stretch of road, eight and one-half miles in distance between Greenville

(Continued on page 36)

San Gabriel Dam Dedicated by Governor Merriam

(Continued from page 9)

currence of a slip on the west abutment in September 1929, work was stopped pending further investigation of the situation.

At this point the State Engineer entered the picture in his official duty of dam supervision, in accordance with an act passed by the State Legislature (Chapter 766, Statutes of 1929) which became effective August 14, 1929. This legislation came as the direct result of agitation following the failure of St. Francis Dam on March 12, 1928. Having for its purpose the safeguarding of life and property, it provides for State supervision of the construction and maintenance of all dams (with the exception of those owned by the United States), and invests these duties in the Department of Public Works to be administered and exercised by the State Engineer.

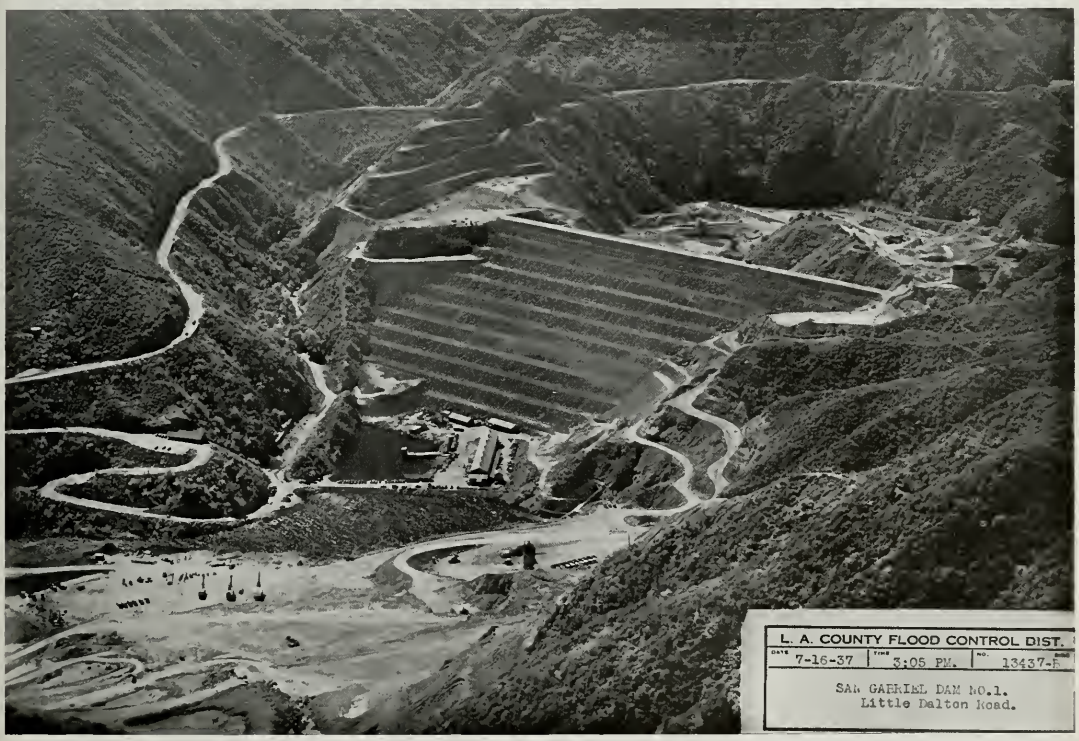
STATE ENGINEER DISAPPROVES

One of the first applications for approval of plans and specifications covering the construction of a dam, received under this act, was that submitted by the Los Angeles County Flood Control District for the Forks Site Dam, on October 26, 1929. Thereupon a careful investigation was made by the State Engineer, assisted by a consulting board of eminent engineers and geologists comprising Charles P. Berkey, G. A. Elliott, M. C. Hinderlider, George D. Louderback, J. L. Savage and Ira A. Williams. After careful consideration the application was disapproved on November 26, 1929.

Following this action the idea of a concrete dam at the Forks Site was abandoned and the District's engineers undertook new studies to determine the best type and location of dams for flood control and conservation on the San Gabriel River. As a result, plans were recommended in 1931 and subsequently adopted for the construction of two reservoirs in place of the one large reservoir originally proposed with the dam at the Forks Site. Both of the dams, designated as San Gabriel No. 1 and No. 2, were planned as rock fill structures.

The plans and specifications for San Gabriel Dam No. 1 were submitted to the State Engineer for approval in February 1932. They provided for a rock fill dam at a site

(Continued on page 28)



View of San Gabriel Dam No. 1 showing stepped face of dam. This picture shows magnitude of this flood control project, largest earth and rock fill dam of its type in the world.

Traffic on State Highways Shows 6.7 Per Cent Increase Over 1936

By T. H. DENNIS, Maintenance Engineer

ALTHOUGH at a somewhat lessened pace, the traffic on California's State highways continues to increase.

The annual summer traffic count taken on Sunday and Monday, July 11 and 12, shows a State-wide increase of 6.7 per cent over the corresponding period in 1936. This compares with an increase of 10 per cent in 1936 and 15.3 per cent in 1935 over preceding years.

Increases were quite uniform in all the various route groups and little difference is noted between the increase in Sunday traffic and that of Monday.

NEW HIGHWAYS RESPONSIBLE

However, the completion during the past year of major construction projects has very markedly influenced the traffic volume upon certain individual highway routes. Route 1 (Sausalito-Oregon Line) shows an increase of 26.45 per cent for Sunday and 12.25 per cent for Monday.

Similarly, on Route 56 (Route 2 at Las Cruces to Route 1 near Fernbridge) increases of 17.23 per cent and 18.18 per cent were recorded for Sunday and Monday respectively. The bulk of this increase was found south of Monterey and resulted from the opening of the Carmel-San Simeon highway to through travel.

USUAL COUNT MADE

In contrast, the heavy decrease shown on Route 74 (Napa Wye to Cordelia via Vallejo and Benicia) was brought about by the opening of the American Canyon, which provides a much more direct route for traffic between the Sacramento Valley and San Francisco Bay areas.

The regular procedure of previous years was followed in making the actual count. This covers the 16-hour period from 6 a.m. to 10 p.m. for both Sunday and Monday. Traffic was segregated by hourly periods into the following vehicle classifications:

California passenger cars, out-of-State passenger cars, busses, light trucks, heavy trucks, trailers drawn by trucks, trailer coaches, and other passenger-car trailers.

At certain points new stations were established for this year's census and in some instances former stations were discontinued or relocated. While all of these will be useful for future comparison, they have been excluded in compiling the percentages of increase or decrease for the present year.

The comparisons for the various groupings are as follows:

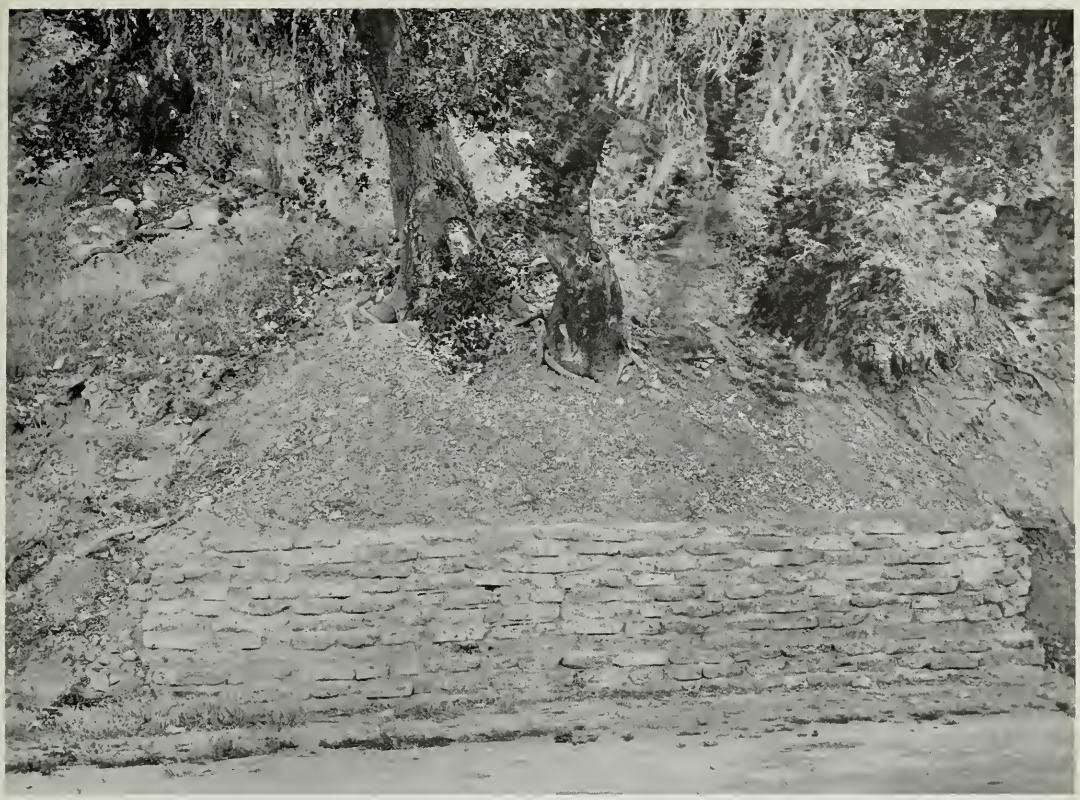
Per Cent Gain or Loss for 1937 Count as Compared with 1936

	Sunday	Monday
All Routes	+6.76	+6.58
Main North and South Routes	+8.25	+6.83
Interstate Connections	+7.65	+6.84
Laterals Between Inland and Coast	+3.96	+3.95
Recreational Routes	+5.78	+9.32

The gain or loss of traffic volume for State Highway Routes 1 to 80, inclusive, which constitute the basis for the foregoing summary, is shown in the following tabulation:

Route	Termini	1937 Per cent gain or loss Sunday Gain	Sunday Loss	Monday Gain	Monday Loss
1.	Sausalito-Oregon Line	26.45		12.25	
2.	Mexico Line-San Francisco	6.25		7.68	
3.	Sacramento-Oregon Line	4.88		5.98	
4.	Los Angeles-Sacramento	4.21		1.87	
5.	Santa Cruz-Jc. Rt. 65 near Mokelumne Hill	0.64		8.19	
6.	Napa-Sacramento via Winters		6.90	12.57	
7.	Crockett-Red Bluff	7.85		12.64	
8.	Ignacio-Cordelia via Napa	10.56			3.06
9.	Rt. 2 near Montalvo-San Bernardino	6.30		2.69	
10.	Rt. 2 at San Lucas-Sequoia National Park	3.51			2.18
11.	Rt. 75 near Antioch-Nevada via Placerville		2.11		3.63
12.	San Diego-El Centro	0.45			3.56
13.	Rt. 4 at Salida-Rt. 23 at Sonora Jc.	15.95		15.59	
14.	Albany-Martinez	9.45		7.10	
15.	Rt. 1 near Calpella-Rt. 37 near Cisco	4.82			9.95
16.	Hopland-Lakeport		5.51		17.32
17.	Rt. 3 at Roseville-Rt. 15, Nevada City	8.39		3.17	
18.	Rt. 4 at Merced-Rt. 40 near Sequoia	0.58		8.32	
19.	Rt. 2 at Fullerton-Rt. 26 at Beaumont	13.38		13.13	
20.	Rt. 1 near Arcata-Rt. 83 at Park Boundary	24.50		9.78	
21.	Rt. 3 near Richvale-Rt. 29 near Chilcoot via Quincy		13.23		10.35
22.	Rt. 56, Castroville-Rt. 29 via Hollister	9.12		14.49	
23.	Rt. 4 at Tunnel Sta.-Rt. 11, Alpine Jc.		0.41	2.63	
24.	Rt. 4 near Lodi-Nevada State Line	10.23			1.78
25.	Rt. 37 at Colfax-Rt. 83 near Sattley	4.13			6.67
26.	Los Angeles-Mexico via San Bernardino	9.09		7.79	
27.	El Centro-Yuma	15.72		16.19	
28.	Redding-Nevada Line via Alturas	16.99		11.04	
29.	Peanut-Nevada Line near Purdy's	32.34		15.42	
31.	Colton-Nevada State Line	2.66		5.63	
32.	Rt. 56, Watsonville-Rt. 4 near Calif a	11.78			1.24
33.	Rt. 56 near Cambria-Rt. 4 near Famosa	4.14		14.56	
34.	Rt. 4 at Galt-Rt. 23 at Pickett's Jc.		21.82		8.61
35.	Rt. 1 at Alto-Rt. 20 at Douglas City		4.46	3.73	
37.	Auburn-Truckee	2.11		4.30	
38.	Rt. 11 at Mays-Nevada Line via Truckee River		1.94		4.20
39.	Rt. 38 at Tahoe City-Nevada State Line	11.98		7.12	
40.	Rt. 13 near Montezuma-Rt. 76 at Benton	15.80		3.07	
41.	Rt. 5 near Tracy-Kings River Canyon via Fresno	28.82		17.47	
42.	Redwood Park-Los Gatos		7.08	7.68	
43.	Rt. 60 at Newport Beach-Rt. 31 near Victorville	9.75		11.64	
44.	Boulder Creek-Redwood Park	10.03		10.56	
45.	Rt. 7, Willows-Rt. 3 near Briggs	0.42		1.04	
46.	Rt. 1 near Klamath-Rt. 3 near Cray		2.64		13.11
47.	Rt. 7, Orland-Rt. 29 near Morgan	26.28		16.31	
48.	Rt. 1 N. of Cloverdale-Rt. 56 near Albion	2.11		4.55	
49.	Napa-Rt. 15 near Sweet Hollow Summit		6.55	1.11	
50.	Sacramento-Rt. 15 near Wilbur Springs		10.69	15.05	
51.	Rt. 8 at Schellville-Sebastopol	8.14		15.87	
52.	Alto-Tiburon	11.36		2.25	
53.	Rt. 7 at Fairfied-Rt. 4 at Lodi via Rio Vista	2.48		1.27	
54.	Rt. 11 at Perkins-Rt. 65 at Central House		1.33		10.58
55.	Rt. 5 near Glenwood-San Francisco		16.46		13.93
56.	Rt. 2 at Las Cruces-Rt. 1 near Fernbridge	17.23		18.18	
57.	Rt. 2 near Santa Maria-Rt. 23 near Freeman via Bakersfield	12.85		10.34	
58.	Rt. 2 near Santa Margarita-Arizona Line near Topock via Mojave and Barstow	3.86		15.71	
59.	Rt. 4 at Gorman-Rt. 43 at Lake Arrowhead		2.99		0.42
60.	Rt. 2 at Serra-Rt. 2 at El Rio	5.03		10.85	
61.	Rt. 4 S. of Glendale-Rt. 59 near Phelan	10.25		5.18	
62.	Rt. 171 at Northam-Rt. 61 near Crystal Lake	31.97		21.88	
63.	Big Pine-Nevada State Line	90.18		60.32	
64.	Rt. 2 at San Juan Capistrano-Blythe	25.80		25.26	
65.	Rt. 18 near Mariposa-Auburn		6.84		7.16
66.	Rt. 5 near Mossdale-Rt. 13 near Oakdale		2.07	6.05	
67.	Pajaro River-Rt. 2 near San Benito River Bridge	4.30		No change	
68.	San Jose-San Francisco	15.62		14.29	
69.	Rt. 5 at Warm Srings-Rt. 1, San Rafael		4.30		23.15
70.	Ukiah-Talmage	5.10		14.84	
71.	Crescent City-Oregon Line	14.54			1.51
72.	Weed-Oregon Line	9.66		14.65	
73.	Rt. 29 near Johnstonville-Oregon Line	38.89		13.77	

(Continued on page 36)



This picture shows how oak trees on highway in Monterey County were protected from erosion by state road builders.

Highway Engineers Preserve Roadside Growth

THE amount of extra work that highway engineers are willing to undertake in an effort to preserve native roadside growth is aptly illustrated in the accompanying photograph, which shows two trees on State highway V-Mon-2-H, directly south of San Ardo in Monterey County.

These California live oaks, although not particularly fine specimens of their species, were allowed to remain on the slope above a cut because both trees overhang the roadway and create a pleasing skyline effect from each approach on the traveled way.

Susequent erosion of the cut slope, however, bared the anchor roots on the road side of the trees and caused the death of feeding roots on that side. It was obvious that unless preventive means were taken this erosion would continue until the trees became a hazard to traffic and had to be removed. As this was not desired, Herb Cooper, district maintenance engineer at San Luis Obispo, requested Maintenance Superintendent R. S. Peck to accomplish the work necessary to prolong the life of the trees.

To this end, roots were first filled around with soil to a natural repose slope. A wet rubble wall of broken concrete was then placed from the gutter line into the eroded slope and approximately five feet in height. This wall was stepped at eighteen inches to provide greater stability and to break up the unattractive appearance that a straight wall would have presented, especially on the approach from the north. The remaining area within the wall was then filled with soil and brought up to the approximate original ground level.

A certain amount of erosion will continue, but the ill effects to the trees have been checked. An examination of the photograph will show the growth of natural ground cover, seeds of which will undoubtedly lodge in the loose earth of the new fill and help to stabilize this surface.

(Continued on page 32)

New Road Conquers Waste Lands From Mountain Pass to Nevada

By C. V. KANE, Resident Engineer

COMPLETION recently of that portion of the interstate highway, connecting Los Angeles with Las Vegas, Nevada, and Salt Lake, from Mountain Pass to the Nevada State line in San Bernardino County directs attention to the continual progress being made by the California Division of Highways in providing better facilities for transportation within this state.

This important route has just been brought up to modern standards of grade and line. The improvement has advanced by sections through the rough mountain and desert wastelands of northeastern San Bernardino County over a period of years.

While this interstate highway has long been an important route into Southern California, construction of the Boulder Dam and development of modern road facilities to Bryce Canyon and Mt. Zion National Parks have greatly increased both recreational and commercial travel over the 186 miles between San Bernardino and Nevada.

BIG DROP IN ELEVATION

The contract just completed provided construction to standards of alignment and grade compatible with present day engineering practice for mountain road construction.

Connecting with the section of road completed a few years ago at Mountain Pass about 34 miles northeast of Baker the new highway drops from about elevation 4700 along a line which involved much heavy grading to the bed of Ivanpah Lake some 2000 feet below.

The line of the highway on this portion of the route has a minimum curvature of 1760 feet and the maximum grade is 6%. The roadbed is a standard 36-foot width with bituminous surfacing 20 feet wide.

For the four miles across the dry lake bed to the State Line the roadbed was constructed on a 3½-foot fill. The embankment across the lake was constructed of fine silt taken from the lake bottom and blanketed completely, including the slopes, with a limestone shale rock, equivalent in grading to a crushed ledge rock; the blanket material was secured from a naturally fractured local ledge, which, when placed over the roadway, produced a solid foundation to efficiently prevent damage to the oil surfacing.

Culverts placed in the fill at 1000 foot intervals across the lake prevent the embankment's becoming a dam, and it is intended that water flow in either direction through the culverts, depending on which side of the lake the usual summer torrential cloudbursts occur. Crossings of dry washes were made with 75 and 90 inch multiplate culverts and timber bridge openings were provided for the storm waters to be concentrated from the expansive alluvial cone by a system of parallel ditches and dikes.

ROAD-MIX SURFACE

The surfacing was road-mixed type, placed five inches thick. Where roadside material was unsatisfactory, aggregate for the surfacing, without grading, crushing or scalping, was secured from adjacent pits and the roadway excavation. It was required that rocks over 2½ inches be removed from the surface of the pavement. To afford adequate blade finishing with this large-size aggregate, and incidentally improve the quality of the pavement, a sheepsfoot tamper was used to force the large rocks below the surface and to secure compaction from the bottom up.

The earthwork on the project amounted to 485,000 cubic yards, of which 20% was solid rock, and 12,000,000 station yards of overhaul were necessary. Two thousand tons of road oil were shipped in by rail and heated with retorts as used on the job.

This project was authorized in the Highway Budget for the 87th and 88th fiscal years, and was partially financed with Federal funds. The contract was held by George Pollock Company of Sacramento, award being made in August, 1936, and the work completed in June, 1937. Again engineers had won against desert odds.

Arizona Thinks California Road Signs Excellent

Editor,
California Highways
and Public Works,
Sacramento, Calif.

Dear Sir: I have just completed reading an article in your May magazine by F. M. Carter, Assistant Maintenance Engineer, in regard to directional road signs.

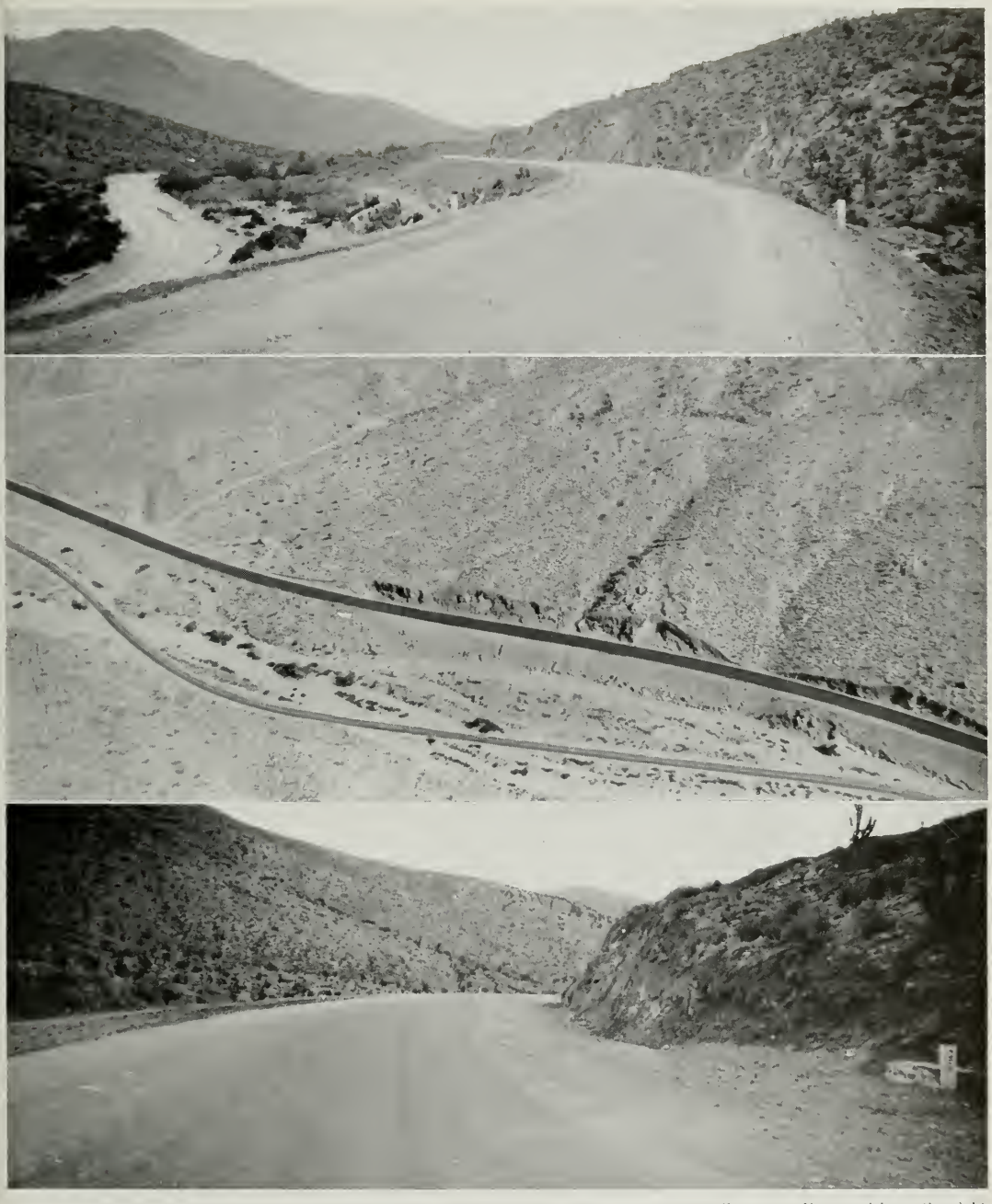
I was much impressed with the article but I believe it did not give due credit to the completeness with which most of your roads are signed.

I just returned from a trip through Southern California where I had to contact a number of widely scattered persons in regard to land they owned in Arizona and I was truly amazed at the accuracy with which the California road signs located the places I was looking for. Some of them were quite out of the way.

It is my opinion that California is years ahead of any other Western State and most of the Eastern states in so far as their road signs are concerned.

Cordially,

JACK D. SHELEY,
Right of Way Agent,
Arizona State Highway Department.



The upper picture shows section of Mountain Pass to Las Vegas route before and after realignment. New road is on the right. Center—Aerial photograph of completed highway through Mountain Pass. Note old road meandering along creek bottom. New highway is on higher ground where it will be safe from floods. Lower—Another view of finished highway.

Vehicles Using Bay Bridge Reach Total of 6,723,948 in July

AN INCREASE in practically every type of vehicle crossing the San Francisco-Oakland Bay Bridge for the month of July was announced by Director of Public Works Earl Lee Kelly, with the accumulated count totaling 886,054.

Only exception was in the truck trailer division due to a change in rating, which now classifies the semi-trailer as a single truck.

July's traffic brings the total number of vehicles to cross the great span since its opening to 6,723,948, according to Mr. Kelly from figures revealed in the monthly traffic report of State Highway Engineer C. H. Purcell.

"Highest day's traffic was on Sunday, July 4, when 36,280 vehicles crossed the bridge," Mr. Kelly said. "Second high point was Sunday, July 25, which had 35,647 vehicles. Lowest day was July 7, when 24,967 vehicles crossed the structure."

DAILY AVERAGE 28,582

The daily average number of vehicles for last month was 28,582 with the total collections for July amounting to $469,258.81.

The number of auto trailers crossing the bridge continued to increase, with a total of 2,726 for July, compared to 1,826 for the preceding month. Trucks and freight pounds also showed an encouraging increase with 68,409,499 freight pounds for July in comparison with 65,169,333 pounds for June.

There were 28,436 trucks crossing the San Francisco-Oakland Bay Bridge in July, showing an increase over the 28,024 trucks for the preceding month.

Comparative figures are:

	Passenger Autos	Auto Trailers	Motor Cycles	Tri-Cars
June	785,524	1,826	3,361	676
July	839,231	2,726	3,716	824

	Trucks	Buses	Truck Trailers
June	28,024	9,109	2,347
July	28,436	9,819	1,302

	Total Vehicles	Extra Passengers	Freight Pounds
June	830,867	193,118	65,169,333
July	886,054	209,971	68,409,499

Bay Bridge Terminal Construction Under Way

CONSTRUCTION of the San Francisco-Oakland Bay Bridge railway terminal in San Francisco is under way.

Electric trains will be operating over the transbay system of the span by November, 1938, according to Chief Engineer C. H. Purcell.

With the awarding of bids by Director of Public Works Earl Lee Kelly last month, the work of demolishing buildings remaining on the terminal site was hastened.

Contracts awarded total $2,283,377 and call for general construction of the terminal, structural steelwork for it and the street crossings of the train viaduct approach and mechanical and electrical work on the terminal.

MILLIONS OF POUNDS OF STEEL

Approximately 4,000,000 pounds of structural steel will be required for the street crossings of the viaducts, 2,800,000 pounds of steel roof framing for the terminal and 560,000 pounds for the catenary bridges.

Mechanical work on the terminal will include installation of plumbing fixtures and service piping, water piping and gas piping systems, boilers, oil tanks, radiators, etc.

The electrical installation will include a public address system for calling trains, fire alarm system, general lighting, clocks, signs, power wiring, etc.

PROVIDES FOR TRAFFIC INCREASE

The proposed terminal building will face Mission Street and the entire area including the head house and viaducts will extend just east of Second Street on the west boundary and east of Beale Street on the east boundary.

The terminal has been designed to provide for a fifty per cent increase over present commuter traffic between San Francisco and the East Bay and is expected to be sufficient to accommodate with ease all traffic for the next thirty years on the basis of every passenger being seated.

Tracks and loading platforms will be entirely roofed over a length of 700 feet with large skylights and windows providing ample lighting. Trains will come in to the terminal over six tracks which will be arranged in pairs with platforms between alternate trains.

LARGE WAITING ROOM

The main station width will be 164 feet. A fence will be placed between adjacent tracks in order to prevent hazards to passengers from incoming and outgoing trains.

The terminal will contain a large waiting room in the center of the station on the ground floor with access to four streets—Mission, Fremont, First and Natoma. Passengers leaving the bridge trains which come in on the elevated train level above the mezzanine floor need not pass through this waiting room but may leave the concourse by means of outdoor or indoor ramps to be located in front of the head house and at each end of the station.

Rest rooms, restaurants, first aid rooms, concessions, telegraph offices and telephones will be situated around the waiting room. On the mezzanine floor, between the ground floor and the track level, information booths, ticket offices, directional signs and concessions will be located.

NOISE ELIMINATED

From this mezzanine floor, passengers may travel directly to the street cars which will stop just outside the station on the same level as the mezzanine floor.

All the terminal will be of reinforced concrete or structural steel. It will have acoustical treatment in order to eliminate all noise possible. Floors will be of terrazzo and the walls of the waiting room of terra cotta tile.

Low bidders for the terminal work are: General Construction, MacDonald and Kahn, Ltd., $1,658,510; Structural Steelwork, Columbia Steel Company, $442,360; Mechanical, Scott Company, Inc., $109,257; and Electrical, Radelfinger Bros., $73,250. All are San Francisco firms.

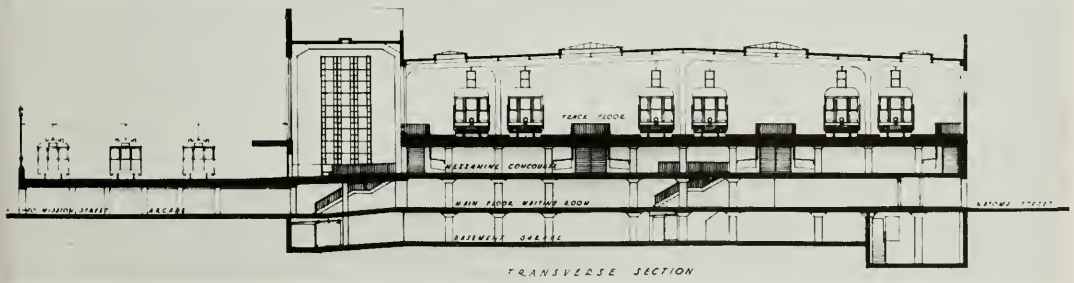
The children always know when there's company downstairs—they can hear mother laughing at father's jokes.



Artist's view of Bay Bridge terminal building and approaches. Ferry Building and Market Street in right foreground.



Most recent architect's drawing of Bay Bridge terminal through which it is expected 35,000,000 persons will pass annually.



Drawing showing interior of terminal with interurban train track floor, mezzanine concourse, main waiting room, garage and arcade leading to Mission Street trolley cars on extreme left.

San Gabriel Dam Dedicated by Governor Merriam

(Continued from page 21)

located about 3 miles downstream from the original Forks Site. These plans were approved by the State Engineer on June 14, 1932. Actual work was started in February, 1933.

WORK SUSPENDED ON ROCK FILL DAM

Work continued into the fall of 1934 but only limited progress was made owing to the lack of suitable specification rock in the designated quarries in the vicinity of the dam. It became apparent that sufficient rock of suitable quality could not be obtained, within the funds provided, to complete the dam in accord with the plans proposed. Realizing that further attempts to build a rock fill dam under the contract specifications would be futile, the District ordered the contractor to temporarily suspend work on November 13, 1934.

Studies were initiated immediately by the District to revise the plans for the structure. Because of the unusual complexities involved, numerous alternate plans were prepared and carefully considered. The final plans for the completed earth and rock fill dam were adopted only after exhaustive study and mature deliberation.

During the course of their preparation, Director of Public Works Earl Lee Kelly, the State Engineer and dam supervision staff headed by Deputy State Engineer Geo. W. Hawley, ably assisted by the State's consultants, F. C. Herrmann, C. D. Marx and W. L. Huber, closely cooperated and collaborated with the District's engineers. These plans, prepared under C. H. Howell who replaced Mr. Eaton as Chief Engineer of the district in February 1935, were approved by the District on July 26, 1935, and by the State Engineer on August 12, 1935. Work was immediately resumed by the contractor.

DESIGN IS UNIQUE

The design for San Gabriel Dam No. 1 is unique among high dams of the embankment type. It is predicated chiefly upon utilizing, in such a manner as to obtain the maximum of safety and stability, the existing rock and earth materials available in the vicinity of the site.

For this purpose the adopted plan provided for the construction of the embankment in six zones of different material, comprising in general an upstream section (Zone 1) of quarry-run rock to resist wave action and to support and protect the main body of the dam; a sloping section (Zone 2) of selected impervious material connecting with a concrete cutoff wall and resting upon a gunite surfacing over the canyon walls and foundation; a central section (Zone 3) forming the main body of the dam, consisting of a rolled earth fill with side slopes of 2:1 upstream and 1:1 downstream to provide an unyielding and relatively impermeable support for Zone 2; and three sloping sections (Zones 4, 5, and 6) downstream to provide support and consisting of porous material ranging from small rock to the largest rock available in the farthest downstream section. The fine material placed in impervious Zones 2 and 3 was spread in layers and sprinkled and rolled to required compaction. The coarser material in Zones 1, 4, 5 and 6 was placed with the aid of sluicing operations.

381 FEET HIGH

The dam as constructed has a maximum height of 381 feet from the lowest point on the foundation to the crown. Its crest length across the canyon is 1500 feet. Its top width is 40 feet while its width on the base is 1950 feet or nearly three-eighths of a mile. The up and downstream slopes average 3:1, but as constructed rise in steps as shown in the accompanying photograph.

Ample spillway capacity is provided which is especially essential for this type of dam. The spillway which is now under construction will have a discharge capacity of 80,000 second-feet with 15-foot freeboard and an estimated 200,000 second-feet or more before the dam is overtopped.

The construction of this dam required the moving of a veritable mountain of earth and rock material from the adjoining hillsides into the canyon. 10,572,000 cubic yards of earth and rock were excavated from the quarries by giant shovels, transported by a large fleet of trucks, and placed in the dam. All previous records were smashed by the contractor in the rapidity and efficiency with which this work was carried out. As much as 965,000 yards was placed in a single month. The entire earth fill structure was completed in about 11½ months. One of the speakers at the dedication ceremony illustrated the vast amount of material in the dam by this comparison. "If the rock used were loaded in flat cars, 45 tons to a car, and combined into one train, this train would be 11,300 miles in length."

OUTSTANDING ACHIEVEMENT

Completion of San Gabriel Dam No. 1 constitutes an outstanding engineering achievement—a triumph of engineers' genius and constructors' skill over unusually difficult physical conditions. But also it is a monument to the farsighted vision, careful planning and determined aggressiveness of a community that carried on in spite of complications, unforeseen difficulties and discouraging delays until the dam was successfully completed.

After years of effort, storage development on the San Gabriel River providing necessary flood control and water conservation has been completed—with the two dams built by the Flood Control District and a third (Morris Dam) built by the City of Pasadena a few miles downstream from San Gabriel Dam No. 1.

All of these dams were designed and constructed under State supervision. In the interest of safety, the greatest care was exercised by the State Engineer not only in checking the sufficiency of the plans but also by constant and painstaking inspection of every detail of the work as it proceeded, particularly with respect to the preparation and treatment of the foundation and cut-off. Consequently, the citizens of Los Angeles County and the residents along the San Gabriel River downstream who are more vitally concerned, have the assurance that the State's supervision has required the application of every known means and the utmost of precaution to insure the safety and stability of these dams.

Work of Straightening Curves On Cuesta Grade Is Under Way

(Continued from page 12)

On the southerly slope there will be sustained 7% gradient 2.27 miles long. Passing over the summit the new road will continue along the supporting easterly slope on a down gradient of 7% for one-half mile, and will cross the Southern Pacific Railroad on an overhead structure. This bridge will have a width between wheel guard of 50 feet.

The plans call for a 52-foot width of roadbed in cuts and a 58-foot width in fills. This provides for a 21-foot surfacing on each side of a center parting strip with 3-foot shoulders in cuts and 6-foot shoulders in fills. Opposing lines of traffic are to be separated by a 4-foot neutral strip along the center. This neutral strip will be 0.5 foot higher than the traffic lanes and the top will be sealed to prevent water percolating through into the subgrade. As the surfacing is to be in the nature of "Stage Construction," due to possible fill settlement after construction, this neutral strip will be curbed with a temporary curbing which will be broken at intervals to provide cross-overs.

The wearing surface is to be 0.25-foot of plant mixed surfacing placed on a .42-foot thickness of crusher run base placed under the traffic lanes. The plant-mixed top course will extend out over the shoulders and embankment dykes on fills, and on the shoulders and over the side ditches in cuts.

NUMEROUS TURNOUTS

Numerous turnouts, large enough to accommodate the largest of transportation units, will be provided. In order to make this provision it is planned to "ball nose" (round the ends) the cuts and widen the adjoining fills accordingly.

The maximum fill on the project will contain 122,000 cu. yds. It will be 350 feet long, have a maximum center height of 92 feet, and a maximum height at the toe of 169 feet. The summit cut is 1400 feet long and the maximum cut at this location at top of slopes, is 70 feet.

Further down the southerly slope one side hill cut contains 165,866 cubic yards, and has a maximum slope cut of 183 feet. At this location there is planned a catch bench 20 feet wide about one-half way between the roadbed and the top of slope. This is the heaviest concentrated cut yardage on the project.

YEAR'S WORK AHEAD

The following tabulation gives a comparison of design features between the existing road and the one now planned:

	Present	Planned
Number of Curves	71	12
Minimum Radius	60 feet	800 feet
Total Delta of Curves	3633°	408°
Average Grade	6.222%	7%
Maximum Grade	7%	7%
Minimum Vertical Sight Distance	275 feet	440 feet
Distance Saving		0.72 Mile

All work should be completed and the road opened for traffic in the latter part of 1938. This will make it available for the heavy traffic expected on U. S. 101 with the opening of San Francisco's Golden Gate Exposition in 1939.

HIGHWAY PROGRESS PUTS END TO OBSOLETE ROAD

(Continued from page 14)

of the Valley Boulevard from Colton to Ontario to a three lane highway.

The project, approximately one and three-tenths miles in length, decreases the distance of the old and more circuitous road by five-tenths of a mile. It eliminates three approximately right angle turns at street intersections, eliminating in all about 360° of turns and curvature. It eliminated a dangerous bridge of narrow width and of low load carrying capacity.

It gives the motorist for the first time a route, on this heavily traveled highway, that does not involve impeded progress between Colton and Redlands.

Traffic Menaces on Sherwin Hill Are Eliminated

(Continued from page 10)

around projecting points and back into the ravines. Cutting through points and filling across ravines were not attempted. The result was that alignment in the rougher topography near the summit consisted almost entirely of a series of short radius curves on an eight per cent grade. About one-third of the distance up from the foot of the grade there was a series of eight curves connecting seven switchbacks.

In 1935 the work of improving the alignment, widening the roadbed from 16 feet to 24 feet, and increasing the traveled way surface from 14 feet to 18 feet, was started. This work, after being closed down in June, 1935, was resumed in December, 1936.

The improvement of the alignment consisted of cutting off projecting points and building or widening embankments across ravines in order that adequate sight distance for the passing of slow moving vehicles by faster moving traffic will be secured wherever feasible. These numerous alignment changes are generally not over 200 feet in length and do not involve a shift in the center line of the highway of more than 50 feet. With the completion of the work, it is felt that a highway of sufficiently high standard will result, to meet the needs of the traveling public until such time as funds become available for the relocation and reconstruction of this section of highway in accordance with up-to-date standards on easier alignment and grades.

RELOCATION NEEDED

From the surveys and studies which have been made of the possible routes for such a relocation of this highway from the Inyo-Mono County line to Yerby's, a distance of 10.8 miles, it is estimated that approximately $400,000 will be required for its construction.

Old Colored Mammy: "I want a ticket for Magnolia."

Ticket Agent (after ten minutes of weary thumbing over railroad guides): "Where is Magnolia?"

Old Colored Mammy: "She's settin' over dar on de bench."

Michigan Uses General Fund For Highways

IN order to enlarge the scope of its highway building program, the State of Michigan through legislative enactment has appropriated $5,000,000 from its general fund for expenditure on roads and highways.

Writing to State Highway Engineer C. H. Purcell, Michigan's Highway Commissioner, Murray D. Van Wagoner, says his state has established a precedent in highway finance. Mr. Van Wagoner wrote:

"The Michigan legislature, which adjourned a short time ago, established a precedent in highway finance by enacting a continuing appropriation of $5,000,000 a year from the state's general fund to the Michigan State Highway Department.

"I believe that this is the first instance in the United States of the establishment of the principle that revenues other than specific motor vehicle taxes should be allocated for highway purposes. Here, for the first time, an appropriation from the general fund has been made supplementing motor vehicle revenue. In this instance, the revenue is obtained from the state's 3 per cent sales tax.

"Hence, in Michigan there is not only no diversion of highway revenues for other than highway purposes but also the use of revenues from general taxation for these purposes. It is my thought in transmitting these bills that they, together with the broad, underlying principle they embody, will be of interest to highway authorities throughout the country."

The act passed by the Michigan legislature reads as follows:

Section 1. There is hereby appropriated from the general fund from moneys not otherwise appropriated the sum of five million dollars for the fiscal year ending June thirty, nineteen hundred thirty-eight, and each fiscal year thereafter, for the construction, maintenance and improvement of highways. Such appropriations shall be disbursed as provided by the laws of this state.

This act is ordered to take immediate effect.

Yorba Linda Link Of the Imperial Highway Open

IN Yorba Linda, Orange County, on the evening of July 31, 1937, Governor Frank F. Merriam dedicated Road VII-Ora-176-A, through Yorba Linda. This highway is commonly called Imperial Highway and when completed will run from El Segundo at the ocean to Imperial Valley.

Yorba Linda is located in the northeasterly corner of Orange County and did not have any through highways prior to the completion of Imperial Highway.

The feature of the dedication was a dinner held at the Woman's Club at 6.30 p.m., sponsored by the local Chamber of Commerce and the Imperial Highway Association at which dinner the Governor made the address of the evening.

THREE MILES LONG

The newly completed project for which dedication ceremonies were held, extends from Carolina Avenue easterly of the city of Brea to Lakeview Avenue in the town of Yorba Linda, or a total length of 3.6 miles. The project is graded throughout to a uniform width of 36 feet and surfaced with plant-mixed surfacing.

Through the close cooperation of property owners, the Pacific Electric Railway Company and the State Division of Highways, it was possible to locate this section of highway directly north and adjacent to the Pacific Electric tracks extending, as it does, in a direct line from the city of Brea to Yorba Linda. To accomplish this the State obtained a width of 56 feet from the railroad company right of way plus an additional width of 24 feet from the adjoining private property, making a total right of way width throughout of 80 feet.

ORANGE COUNTY COOPERATED

Orange county officials also cooperated to the extent of allocating $13,000 of county funds for this project in addition to the Highway Commission allocation of $130,000 of the major project allocation for construction for the 87th-88th fiscal years, to complete financing of this highly important project.

Highways Serve To Boost State Fair Attendance

ALL CALIFORNIA roads lead to the State Fair Grounds at Sacramento and this year the traffic over these roads is expected to surpass all records as the great State Exposition opens its gates for ten days, September 3 to 12.

No part of the state is better situated in regard to roads for the people from each and every part of California. Direct arterials from the north and south, east and west, are ready to bring what is expected to be more than 760,000 people into the grounds of the State Agricultural Society.

During Fair time the people of every county of the state are made conscious of the benefits of a unified highway system which permits easy travel from every section of California right to the gates of the fair grounds.

Under the administration and control of the Division of Highways of the Department of Public Works and the California Highway Commission, the network of highways which focus in Sacramento has been brought to standards compatible with the development of modern motor vehicles.

EASY TRANSPORTATION

Present day standards of road construction, providing wide, well-built pavements, superelevated curves of long radius and grades held to a low minimum, enable modern cars and trucks to safely travel the great distances from the far corners of the state to Sacramento in a relatively short time.

Easy transportation of exhibits is bringing a record increase in entries, especially from small individual ranchers and live stock men.

The state-wide web of highways whose units tap even the most outlying sections, will thus draw a traffic flow to the wide arterials and laterals which traverse the state from Oregon to Mexico that will come to rest in but a few hours time in Sacramento during the Fair.

Largely as a result of highway improvement, State Fair attendance has grown almost as rapidly as the increase in improved highway mileage over a period of nearly three decades.


ALL ROADS LEAD TO STATE FAIR
CRESCENT CITY
YREKA
EUREKA
REDDING
SUSANVILLE
RED BLUFF
QUINCY
OROVILLE
RENO
UKIAH
MARYSVILLE
SACRAMENTO
WOODLAND
AUBURN
SANTA ROSA
PLACERVILLE
OAKLAND
STOCKTON
SAN FRANCISCO
MODESTO
MERCED
SANTA CRUZ
SALINAS
FRESNO
PASO ROBLES
SAN LUIS OBISPO
BAKERSFIELD
BARSTOW
SAN BERNARDINO
LOS ANGELES
RIVERSIDE
LONG BEACH

New Travel Records Predicted This Year

Travel in the United States this year will average more than 2,000 miles per inhabitant, according to Roy F. Britton, Director, National Highway Users Conference.

The estimated average for this year is more than four times as great as the 1920 average compiled by the Federal Coordinator of Transportation. It also exceeds the average established in 1929, when the number of passenger automobiles was at least 1,000,000 less than the present total.

The annual total of passenger miles traveled in private automobiles now is at least eight times as great as the passenger-mile total recorded for the railroads in 1920, when rail travel was at its peak, Mr. Britton states.

LOW ACCIDENT RECORD

The lowest number of accidents for any month since the opening of the San Francisco-Oakland Bay Bridge was announced for July by C. H. Purcell, State Highway Engineer. Although approximately 880,000 vehicles, averaging more than 28,000 a day, crossed the span in the 31-day month of July, there were only 4 accidents, one of which resulted in injury. Three accidents occurred on the bridge proper and one on the approaches.

Meanwhile, 675 vehicles were serviced last month by the Bay Bridge Roadside Service, or an average number of 21.8 vehicles serviced per day. This brings the total number of vehicles serviced since the opening of the bridge to 5,632.

ENGINEERS PRESERVE HIGHWAY GROWTH

(Continued from page 23)

Such work as this can not be measured in actual cost of construction but must be regarded as having saved the Maintenance Department the considerable expenditure of funds that would have been required had the trees remained untreated and their removal been necessary as a safeguard to the traveling public. Also, we may consider that an actual asset to the appearance of the highway has been preserved, the value of which can be measured only by the appreciation of the individual of natural beauty.

New Viaduct Adds Link in Highway 60

WITH the recent completion of the paving of the approaches to the N and O Street Viaduct in Wilmington, between Wilmington Boulevard and Alameda Street, in Los Angeles County, another link in the Coast Highway was opened to traffic and unrestricted use of the grade separation was made available to the traveling public.

The contract for the grade separation, which included the structure and immediate approaches, was completed in September, 1936. The balance of the approaches, 1.58 miles in length, was graded and surfaced under a separate road contract which was completed June 30, 1937.

NEW LINK IN HIGHWAY

This grade separation, across the yards of the A. T. and S. F. Railway Company, an important grade separation in the metropolitan area of Los Angeles, constitutes a new link in Highway 60.

Traffic which previously had been routed through the business districts of Long Beach and Wilmington now may pass freely through the outlying sections of these cities with relative ease and considerable saving in time. This highway, Route 60, which is better known as Roosevelt Highway, carries traffic from the north and south around the business area of Los Angeles proper by following along the coast. It affords a convenient route to and from the many pleasure beaches along its course, extending from Ventura on the north to San Diego on the south.

Roosevelt Highway along this section of coast was primarily built as an artery for the public to gain access to the beaches. Its final alignment and gentle grades, however, have made it attractive to commercial vehicles.

STEADY TRAFFIC GROWTH

Traffic has steadily grown; in fact, its general use has been such that it has been necessary to widen it again and again to meet the ever increasing demand. Costly right of way was acquired, buildings were removed, existing roads were widened, new pavement placed and grade crossings eliminated.

In accordance with this latter idea the N and O Street overhead was undertaken. The N and O Street grade separation, which is the last major structure built on this highway, is immediately south of Banning Park and carries the highway over the yards of the Santa Fe tracks at Wilmington. At present these yards have six tracks, and the structure has been designed to provide for the expansion of these railroad yards to approximately twice their present size.

The viaduct itself, 411 feet in length, is built on concrete piers and abutments with steel "I" beams carrying the deck. The deck is a combination of reinforced Portland cement concrete and wearing surface of asphaltic concrete. To protect the under side of the deck and structural members from the detrimental effects of the smoke from the railroad trains, blast plates were placed along the lower side of the beams.

The width of the highway is 64 feet from curb to curb with 5 foot sidewalks on both sides. On the approaches of earth fill the roadway is widened to 74 feet.

FEDERAL AID IS GIVEN

Preliminary studies and final designs for both projects were made by the city of Los Angeles working in conjunction with the State Division of Highways. The contract for the approaches, costing approximately $155,000, was financed jointly from the gas tax money and Federal aid. This work was done by the United Concrete Pipe Corporation of Los Angeles. District VII Engineer, S. V. Cortelyou, was represented on the construction work by F. R. Praeht, Resident Engineer. The separation project, costing $226,000, was financed by the Federal Government under the Grade Separation Program. The construction work was done by the contracting firm of Sharp and Fellows of Los Angeles. Resident Engineer W. B. Piper represented F. W. Panhorst, State Bridge Engineer, on the active construction.



The N and O Street Viaduct in Wilmington in Los Angeles County, shown in upper picture, completes another important link in State Highway 60 and will be an important grade crossing for many years to come. Lower—View of west approach to viaduct showing splendid alignment.

RETIREMENT OF COL. ROBERT B. MARSHALL IS LOSS TO PUBLIC WORKS DEPARTMENT

COLONEL Robert B. Marshall, an employee of the Division of Highways at Central Office, has retired from State service, having reached retirement age.

While Colonel Marshall had only been in the State service since 1928, his public service started in 1889, when he was appointed Assistant Topographer in the United States Geographic Survey. In 1891, he was assigned to California. He advanced through the various grades of the Geographic service until, in 1908, he was appointed Chief Geographer. In 1915, he became Superintendent of National Parks, in addition to his duties as Chief Geographer. In 1917, he was commissioner in the Engineers Corps of the United States Army with rank of Major, and advaneed the next year to rank of Lieutenant Colonel. During this period he supervised military mapping work, along with his geographic duties.

FATHERED MARSHALL PLAN

From 1919 to 1925, Colonel Marshall was Consulting Engineer for the California State Irrigation Association, fathering the Marshall Plan for the comprehensive, coordinated development, conservation, and use of water resources of California. This is now called the State Central Valley Water Plan, and actual construction is getting under way at Kennett, Friant, and in Contra Costa County.

Colonel Marshall had charge of establishing the Geological Survey office in the Post Office Building in Sacramento, and, also, the establishing and inauguration of cooperation with the State of the topographic survey in California. He also organized the topographic surveys for the Hawaiian Islands. He was a member of the Yosemite National Park Commission, appointed in 1904 to change the boundaries of the Park. In 1906, he had charge of the $100,000 fund raised for relief of the sufferers in the San Francisco earthquake.

During his topographic service, he became familiar with every feature of California. He was able to put this knowledge to especially valuable public use in the preliminary development and promotional work connected with the Valley Water Plan.



COL. R. B. MARSHALL

Colonel Marshall was appointed Landscape Engineer in 1928, attached to the office of Mr. B. B. Meek, Director of Public Works. During the last five years, he has been assigned to the Maintenance Department of the Division of Highways in connection with roadside development, preparation of maps, and a variety of special assignments on which his specialized knowledge of the State has been of great value. Colonel Marshall's retirement is a distinct loss to the Department of Public Works, where he will be missed by his co-workers of years.

The automotive industry in the United States last year led all other industries in consumption of gasoline, rubber, steel, malleable iron, mohair, lubricating oil, plate glass, nickel, and lead.

An Editorial and a Letter

States' Splendid Highway Work

Long Beach feels even more than a neighborly interest in Wilmington's celebration of the opening of a two-mile link in the State Highway. Only a few weeks ago Long Beach witnessed, but did not celebrate formally, the completion of a one-mile section of State Street which, with the Wilmington improvement, gives a continuous broad boulevard extending from San Diego to Malibu, along the coast. Now there remains but one stretch, about ten miles in length, north of Malibu, which is less than three lanes in width, until the west line of Santa Barbara is reached.

When one considers the progress that has been made during the past five years in the improvement of the Roosevelt Highway there is good reason to congratulate the State, from the Governor down to the most humble employee of the California Highway Commission, on the splendid showing. True enough, this work was in response to public need and demand; but it is not only the recognition of these calls, but the manner in which the construction has been carried on, including the engineering service, that deserves commendation.

—*Long Beach Press-Telegram*

Mr. Julien D. Roussel,
California Highway Commission,
Sacramento, California.

Dear Mr. Roussel:

Your kindness in writing to commend our editorial on the State Street festivities of June 5th is most gratefully acknowledged. Your Board is doing a great work in many localities, as it is a pleasure to note and to enjoy in one's travels. Our comment on the completion of the Wilmington link had, in fact, a much wider background than those two miles of fine new pavement and a splendid viaduct. More power to you. May you have the support you need to reach the success which you deserve, and which all Californians and their visiting friends will continue to applaud.

Very truly yours,

W. F. PRISK
Editor-Manager
Long Beach Press-Telegram

Highway Bids and Awards for July, 1937

COLUSA AND GLENN COUNTIES—Between Delevan and Logandale, 5.8 miles to be graded and paved with asphalt concrete. District III, Route 7, Section C. A. D. McDonald, Sacramento, $223,961; A. Teichert and Son, Inc., Sacramento, $218,938; N. M. Ball Sons, Berkeley, $238,897; Union Paving Co., San Francisco, $202,666; Chas. L. Harney, San Francisco, $222,647. Contract awarded to Hanrahan Co., San Francisco, $199,425.60.

HUMBOLDT COUNTY—Between Beatrice Overhead and Eureka, 5.2 miles to be surfaced with plant-mix surfacing, shoulders to be constructed of untreated crushed gravel or stone and apply Class "B" seal coat to be applied to the full width of the roadbed. District I, Route 1, Section G. Pacific States Construction Co., San Francisco, $79,867.50; Piazza and Huntley, San Jose, $66,385; Independent Construction Co., Ltd., Oakland, $61,610; A. Teichert and Son, Inc., Sacramento, $66,824; N. M. Ball Sons, Berkeley, $65,667; Hanrahan Company, San Francisco, $110,987. Contract awarded to Hemstreet and Bell, Marysville, $59,920.

IMPERIAL COUNTY—Between Brawley and Mulberry Avenue, 4.0 miles to be graded and surfaced with plant-mix surfaeing. District XI, Route 187, Section Brw., D. B. G. Carroll, San Diego, $74,182; V. R. Dennis Construction Co., San Diego, $72,312; G. W. Ellis, North Hollywood, $76,250; D. W. Thurston, Los Angeles, $82,104. Contract awarded to R. E. Hazard and Sons, San Diego, $65,973.40.

INYO COUNTY—Between Death Valley Junction and State Line, 7.3 miles, road-mix surface treatment to be applied to existing roadbed. District IX, Route 128, Section A. Geo. Herz and Co., San Bernardino, $14,363; A. S. Vinnell Co., Los Angeles, $13,917; Oilfields Trucking Co., Bakersfield, $13,531. Contract awarded to J. A. Casson, Pheonix, Arizona, $12,221.20.

LASSEN COUNTY—Between Lake Leavitt and Litchfield, 3 miles to be graded and surfaced with road-mix surfacing and multiplate arch culverts constructed. District II, Route 73, Section A. Fredericksen and Westbrook, Lower Lake, $53,892; Geo. French, Jr., Stockton, $51,975; Hanrahan Co., San Francisco, $54,815; Union Paving Co., San Francisco, $55,651; A. Teichert and Son, Inc., Sacramento, $56,291; Isbell Construction Co., Reno, $60,541; Hemstreet and Bell, Marysville, $61,380; D. McDonald, Sacramento, $68,253; A. Soda and Son, Oakland, $73,343. Contract awarded to Harms Bros., Litchfield, $51,171.90.

LOS ANGELES COUNTY—Water supply well to be drilled at Saugus Maintenance Station site. District VII, Route 23, Section A. Barber and Bridge Drg. Corp., Los Angeles, $1,412.07; Newton Palm, Ventura, $1,412.07. Contract awarded to Roscoe Moss Co., Los Angeles, $1,412.07.

LOS ANGELES COUNTY—A reinforced concrete slab bridge across Eaton Canyon Wash 1 mile east of San Gabriel consisting of one 58-foot 2½-inch slab span on concrete abutments with timber wing walls and grading and surfacing approaches with plant-mix surfacing. District VII, Route 168, Section C. Oscar Oberg, Los Angeles, $18,821; Geo. J. Bock Co., Los Angeles, $21,942; Claude Fisher Co., Ltd., Los Angeles, $19,871; J. R. Lippincott, Los Angeles, $21,496; Carlo Bongiovanni, Beverly Hills, $19,950; D. A. Loomis, Glendale, $23,010; C. O. Sparks and Mundo Engineering Co., Los Angeles, $22,714; W. H. McCune, Monrovia, $21,986; R. R. Bishop, Long Beach, $23,836; J. E. Haddock, Ltd., Pasadena, $19,003. Contract awarded to Dimmitt and Taylor, Los Angeles, $18,647.70.

MONTEREY COUNTY—A reinforced concrete bridge across Big Creek about 49 miles south of Monterey. District V, Route 56, Section D. C. W. Caletti and Co., San Rafael, $152,398; R. R. Bishop, Long Beach, $163,884; John Rocca, San Rafael, $166,045; M. B. McGowan, Inc., San Francisco, $176,313; Peter J. McHugh, San Francisco, $177,198; Barrett and Hilp, San Francisco, $211,694; Lindgren and Swinnerton, Inc., San Francisco, $242,673. Contract awarded to C. O. Sparks and Mundo Engineering Co., Los Angeles, $146,268.

NEVADA COUNTY—Near Grass Valley, mineral aggregate for road-mix surfacing to be furnished and stockpiled. District III, Routes 15 and 25, Sections B.B. Independent Construction Co., Ltd., Oakland, $14,986; Rock and Gravel Trucking Co., Oakland, $19,470; Harold Smith, St. Helena, $14,042; E. B. Bishop, Orland, $11,564; George Pollock Co., Sacramento, $12,508; Tieslan Bros., Inc., Berkeley, $12,862. Contract awarded to Fredericksen and Westbrook, Lower Lake, $10,502.

ORANGE COUNTY—Between north city limits of Orange and 2 miles north, 2 miles in length to be surfaced with plant-mix surfacing and borders to be constructed. District VIII, Route 43, Section B. Griffith Company, Los Angeles, $10,652; Oswald Bros., Los Angeles, $11,404. Contract awarded to C. O. Sparks and Mundo Engineering Co., Los Angeles, $9,552.98.

RIVERSIDE COUNTY—Between San Jacinto and Moreno, 12.5 miles to be surfaced with plant-mix surfacing and seal coat applied thereto. District VIII, Route 194, Section C. George Herz and Co., San Bernardino, $61,108; R. E. Hazard and Sons, San Diego, $57,850; C. O. Sparks and Mundo Engineering Co., Los Angeles, $67,620; E. L. Yeager, Riverside, $74,747; D. W. Thurston, Los Angeles, $54,585; A. S. Vinnell & Co., Los Angeles, $62,937; United Concrete Pipe Corporation, Los Angeles, $68,069; Bodenhamer Construction Co., Oakland, $68,084. Contract awarded to Oswald Bros., Los Angeles, $54,235.

RIVERSIDE COUNTY—Between Orange County line and Elsinore and between Temecula and San Diego County line, about 32.2 miles, seal coat to be applied to existing pavement. District VIII, Routes 64, 78, Section J.AB. George Herz and Co., San Bernardino, $13,898; R. E. Hazard and Sons, San Diego, $13,835; Matich Bros., Elsinore, $14,428; A. S. Vinnell Co., Los Angeles, $15,909. Contract awarded to Oswald Bros., Los Angeles, $12,465.

SAN BERNARDINO COUNTY—Between Los Angeles County line and San Bernardino, about 20.8 miles to be graded and paved with asphalt concrete. District VIII, Route 9, Section D, Upl., A,B,Ria., C and SBd. C. O. Sparks and Mundo Engineering Co., Los Angeles, $455,567; W. E. Hall Co., Alhambra, $396,846.10; J. E. Haddock, Ltd., Pasadena, $430,929; Griffith Co., Los Angeles, $413,182; Oswald Bros., Los Angeles, $409,286; Daley Corporation, San Diego, $440,334; D. W. Thurston, Los Angeles, $419,921. Contract awarded to United Concrete Pipe Corporation, Los Angeles, $369,453.10.

SAN BERNARDINO AND RIVERSIDE COUNTIES—Various locations, 8.6 miles to be surfaced with plant-mixed surfacing and seal coat applied thereto. District VIII, Routes 193, 190, 77, and 26. George Herz and Co., San Bernardino, $43,714; C. O. Sparks and Mundo Engineering Co., Los Angeles, $42,089; E. L. Yeager, Riverside, $40,776; Oswald Bros. Los Angeles, $38,726. Contract awarded to United Concrete Pipe Corp., Los Angeles, $37,313.60.

SISKIYOU COUNTY—Between Moffet Creek and Route 3, 10.7 miles of road-mix surfacing. District II, Route 82, Section D. Garcia Construction Co., Irvington, $15,000. Contract awarded to Lee J. Immel, Berkeley, $14,187.50.

SONOMA COUNTY—Between 1.2 miles and 3.0 miles east of Petaluma, about 1.8 miles in length to be graded and surfaced with plant-mix surfacing and a timber bridge to be constructed. District IV, Route 104, Section D. Harold Smitb, St. Helena, $32,515; A. Soda and Son, Oakland, $41,963; A. G. Raisch, San Francisco, $30,859; Chas. L. Harney, San Francisco, $31,867; Claude C. Wood, Stockton, $32,298; Pacific States Construction Co., San Francisco, $35,961. Contract awarded to Peter J. McHugh, San Francisco, $30,069.50.

TEHAMA COUNTY—Between Proberta and 1 mile south of Red Bluff, 6 miles to be surfaced with road-mix surfacing. District II, Route 7, Section B. Garcia Construction Co., Irvington, $12,097; Tieslau Bros., Berkeley, $13,872; Lee J. Immel, Berkeley, $14,010; Piazza and Huntley, San Jose, $15,975. Contract awarded to Fredericksen and Westbrook, Lower Lake, $11,967.50.

TULARE COUNTY—Between Visalia and Staffords Corner, 10.3 miles to be surfaced with armor coat and road-mix surface treatment of shoulders. District VI, Routes 133 and 129, Sections A and E. John Jurkovich, Fresno, $24,450; L. A. Brisco, Arroyo Grande, $25,537; N. M. Ball Sons, Berkeley, $25,647; Granite Construction Company, Ltd., Watsonville, $26,990; Stewart and Nuss, Inc., Fresno, $28,100; Piazza and Huntley, San Jose, $29,347. Contract awarded to Union Paving Co., San Francisco, $24,250.

(Continued on page 36)

Construction Work Starts on Altamont Pass

(Continued from page 20)

and Mountain House, be included in the 1937-1939 biennial budget.

EASY GRADE

"Since that meeting, the engineers of the Division of Highways have been busy surveying and going over the entire situation and a complete new alignment was selected. The prevailing grade will be approximately 5% with a maximum not exceeding 6%. This new route will be nearly one mile shorter than the old between Greenville and Mountain House, the number of curves being reduced from sixty to fifteen, total curvature from 1500 degrees to 427 degrees, and the minimum curve radius on the new permanent relocation will be 2000 feet as against the short 250′ radius existing on the old road.

"When the Governor approved the budget late this spring, all preliminary work had been completed and just fifteen days after the beginning of this new biennium we are here assembled for this groundbreaking ceremony."

The pavement of the new highway will consist of a two-lane divided road, to be separated by a raised strip 4 feet wide. This strip is to have redwood curbs 6 inches high on each side of the dividing strip.

The contract for the construction of the new Altamont Pass route involves the largest quantity of grading ever included in one contract of the Division of Highways, Department of Public Works.

It is estimated that the roadway excavation will amount to nearly 1,900,000 cubic yards of earth and rock, and the overhaul on this material will be more than 25,000,000 station yards. Over 10,000,000 gallons of water will be required for embankment compaction and other construction purposes, and nearly 18,000 lineal feet of various sizes of corrugated metal pipe will be needed for drainage purposes.

The cost of the road construction will amount to $920,000.00. Plans for the completed project provided for the construction of four grade separations of the highway with tracks of Southern Pacific and Western Pacific railroads.

While these grade separations, built with Federal aid funds, will be constructed under separate contracts, the Department of Public Works plans to have them completed at the same time as the road construction. The estimated cost is approximately $340,000.00. Highway construction and the four grade separations will amount to approximately a grand total of $1,260,000.

In Memorium

HARRY J. PEARCE

The unexpected death, on August first, of Harry J. Pearce, assistant chief of the Division of Highways central office accounting staff, has left a great void in the Division's personalities. Not only will the large force of employees in the accounting department who were his close associates, miss his kindly supervision, but the entire Division of Highways staff in Sacramento regrets the end of the friendly contacts with Harry Pearce with a feeling of deep personal loss.

Born in Denver, Colorado, on November 28, 1897, Mr. Pearce received his early schooling in Denver and Sparks, Nevada. After graduating from the Sparks High School, he attended the Nevada Commercial Business College in Reno to receive the foundation of his training in accountancy. He moved to Sacramento in 1913 and on October 10, 1917, joined the staff of the California Highway Commission.

Since that time, with the exception of the months spent in military duty at one of the officers training camps in the bay area in 1918, Mr. Pearce has been continuously connected with the Highway Department. During these twenty years of service to the State his proficiency as an accountant, his industrious application to his work, and his marked executive ability carried him high in his chosen field.

It is with all sincerity that the Division of Highways organization extends its deepest sympathy to Mrs. Pearce and her daughter, Barbara Jeanne, in their bereavement.

HIGHWAY BIDS AND AWARDS FOR JULY, 1937

(Continued from page 35)

VENTURA COUNTY—Between Route 2 and 2.5 miles east of Moorpark and between Camarillo and Beetox, 28.7 miles road-mix surface treatment to shoulders. District VII, Routes 9 and 2, Sections AB, BC. Oilfields Trucking Co., Bakersfield, $30,451; Southern California Roads Co., Los Angeles, $29,909; Dimmitt and Taylor, Los Angeles, $28,710; Oswald Bros., Los Angeles, $28,901; A. S. Vinnell Co., Los Angeles, $31,049. Contract awarded to J. E. Haddock, Ltd., Pasadena, $27,851.50.

YOLO AND COLUSA COUNTIES—Between Zamora and Bretona and between Arbuckle and Genevra, 4.3 miles to be surfaced with bituminous macadam. District III, Route 7, Sections C.A. Lee J. Immel, Berkeley, $20,880; E. A. Forde, San Anselmo, $22,476; J. P. Brennan, Redding, $22,316; A. Teichert and Son, Inc., Sacramento, $23,500. Contract awarded to Granite Construction Co., Ltd., Watsonville, $19,-897.60.

YOLO, COLUSA, YUBA, PLACER, NEVADA, EL DORADO COUNTIES—About 43.2 miles seal coat to be applied to existing roadbed. District III, Routes 7, 15, 3, 11, various sections. Granite Construction Co., Watsonville, $28,987; Hayward Building Material Co., Hayward, $29,639; E. A. Forde, San Anselmo, $30,897; Lee J. Immel, Berkeley, $33,194; Pacific Truck Service, Inc., San Jose, $34,023; A. Soda and Son, Oakland, $34,898. Contract awarded to Heafey-Moore Co., and E. F. Hilliard, Sacramento, $28,221.50.

"There are really a lot of smart people in my family," boasted the bore. This caused the girl-friend to reply, "Well, I'd like to meet one of them."

HIGHWAY TRAFFIC SHOWS INCREASE OVER 1936

(Continued from page 22)

Route	Termini	1937 Per cent gain or loss Sunday Gain	Sunday Loss	Monday Gain	Monday Loss
74.	Napa Wye-Cordelia via Valleja and Benicia		42.50		40.74
75.	Oakland-Jc. Rt. 65 at Altaville	9.50		9.57	
76.	Rt. 125 at Shaw Ave.-Nevada State Line near Benton	55.19		35.89	
77.	San Diego-Los Angeles via Pomona	11.30		5.29	
78.	Rt. 12 near Descanso-Rt. 19 near March Field	14.80		9.95	
79.	Rt. 2, Ventura-Rt. 4 at Castaic	6.43		18.82	
80.	Rt. 51, Rincon Creek-Rt. 2 near Zaca	19.33		13.56	

Her mother—I believe that daughter is looking for a husband.

Her father—For goodness' sake! Whose?

Denslow had just bought a second-hand car.

"You w'dn't think it was second-hand, would you?" he said proudly.

"No," said Walker. "I really thought you'd made it yourself."

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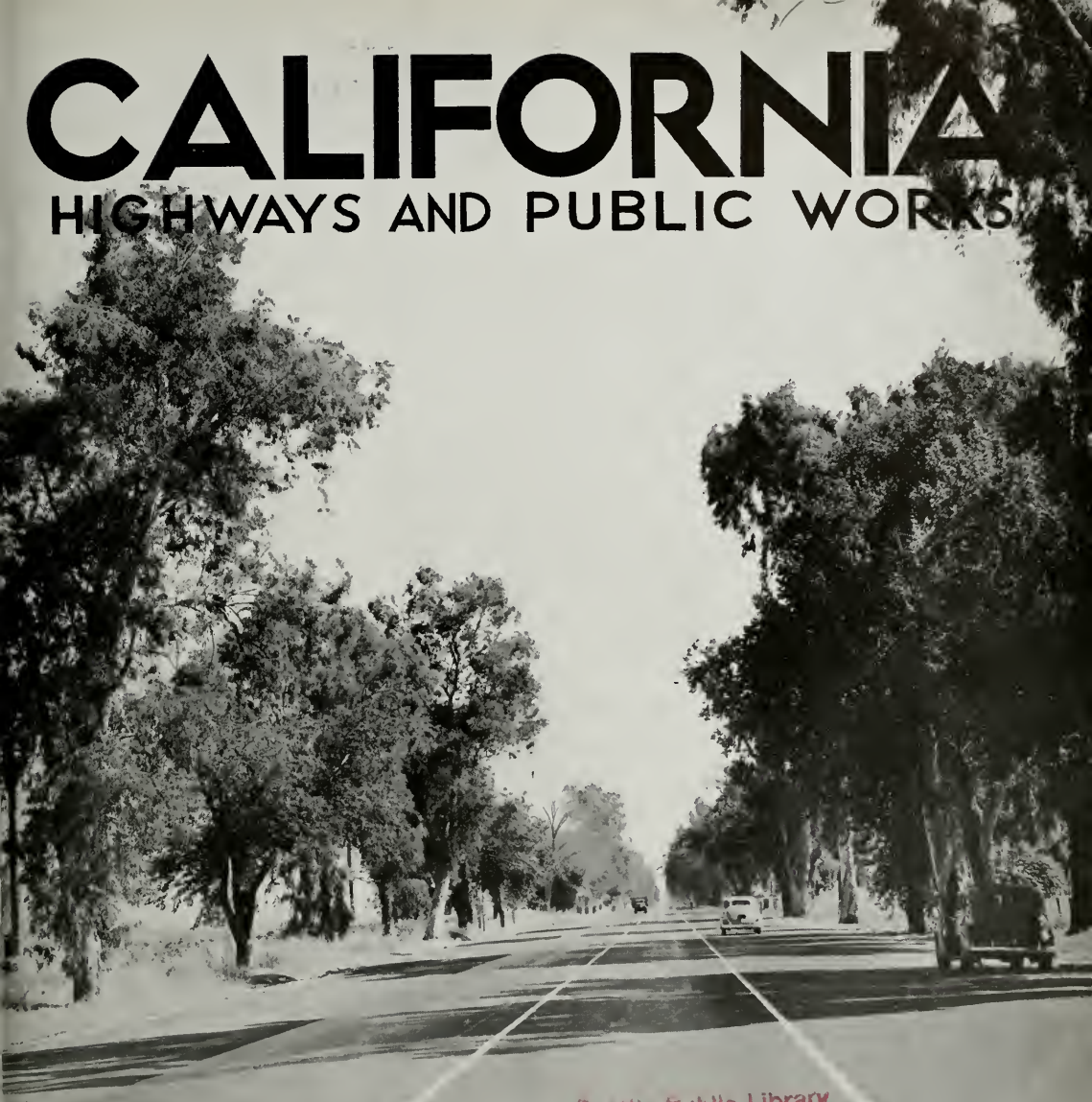
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Official Journal of the Department of Public Works

SEPTEMBER · 1937

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways of the Department of Public Works, State of California

EARL LEE KELLY, Director | C. H. PURCELL, State Highway Engineer | JOHN W. HOWE, Editor

Published for information of the members of the department and the citizens of California

Editors of newspapers and others are privileged to use matter contained herein. Cuts will be gladly loaned upon request.

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Safer Highways

By C. H. PURCELL, State Highway Engineer

SAFETY on our highways is the great concern of many individuals and organizations.

The road building agencies throughout the country have a large responsibility in the construction and maintenance of the highways and can contribute materially in the achievement of this desirable goal.

The United States Bureau of Public Roads, the American Association of State Highway Officials, through its committee on design and its special committee on design policy, are studying and promoting safety design and construction of our highways, to improve the standard and thus reduce the hazard to motor traffic.

PROBLEM MORE SERIOUS

The problem has become more serious because in recent years manufacturers have increased the normal speed of the vehicle, both trucks and touring cars. There has been a decided increase in the use of large busses and of trucks and trailers operating at high speed. This means increased hazards for both approaching and passing vehicles.

The present ten-foot width of lane provides insufficient clearance for this increased volume of vehicles, both large and small operating at greater speed. The timid driver hesitates to pass trucks with trailers and the wide busses on the ten-foot lane and this has a tendency to pile up cars behind him and to require a longer time limit for passing.

TEN-FOOT LANE INADEQUATE

When the faster moving vehicle overtakes the slower one, which is usually the wide type, such as truck or bus, vision is obscured and the resulting effect is that when the faster car does attempt to pass it swings out widely both for vision and clearance and usually passes beyond the edge of the pavement onto the shoulder.

The record of traffic accidents in California shows that the percentage of overtaking accidents or sideswiping, is in excess of the approaching type of accident. Evidently more clearance is needed. Experience and observation both confirm the conclusion that a ten-foot traffic lane is no longer adequate for modern high-speed traffic.

The California Division of Highways has adopted a new standard of construction for state highways which provides for an increased width of lane. The present ten-foot lane is to be widened to a basic eleven-foot width, making the two-lane roadway 22 feet wide instead of the previous 20 feet.



C. H. PURCELL

NEW WIDTH DESIGN

A standard of 11-foot width of lane for three-lane highways has also been adopted and these will be designed to provide for future expansion into four-lane divided highways with minimum loss of investment. The multiple lane highway of four lanes or more will be a divided highway providing for two roadways in each direction with a dividing or separating strip between them. The standard of construction adopted for these roads is a 12-foot width of lane for the inside lane adjacent to the dividing strip and an 11-foot width for the outside lane. The inside lane of 12-foot width will provide more freedom for the car traveling in this lane while passing and greater freedom and mobility in case of crowding. The outside lane does not require this additional width since it has a shoulder still available to maneuver upon in case of necessity.

PLAN FOR FUTURE

Only a relatively small percentage of our highways will be of the divided type. The majority of our roads will always continue to be two-lane roads since that width will accommodate the traffic requirements based on the volume and character of traffic using them. Our planning of the narrower roads now constructed must consider the ultimate development or we will be forced to waste some parts of the pavement.

To conform to this additional width of pavement on the roadway we are also increasing the width between curbs of structures such as bridges and grade separations. The additional width provided is two feet beyond the edge of the pavement lanes.

In other words a bridge on a two-lane highway having a 22-foot width of pavement will be 26 feet wide between curbs and the clearance on a structure on a divided roadway will be 27 feet between curbs for each roadway.

DEVELOPING DESIGNS

Designs have been and are being developed for this widened pavement and also for the divided type of roadway, both for new construction and

(Continued on page 6)

Drilling Costs Cut by New Rig for Foundation Investigations

By O. J. PORTER, Associate Physical Testing Engineer,
Materials and Research Department

THE Equipment Department has constructed a combination foundation drilling rig from plans prepared by engineers of the Materials and Research Department, Division of Highways.

The equipment described herein was designed and built after a number of years boring experience with inadequate well drilling rigs, and construction of the outfit was resorted to only after a thorough investigation indicated that a suitable outfit was not manufactured commercially.

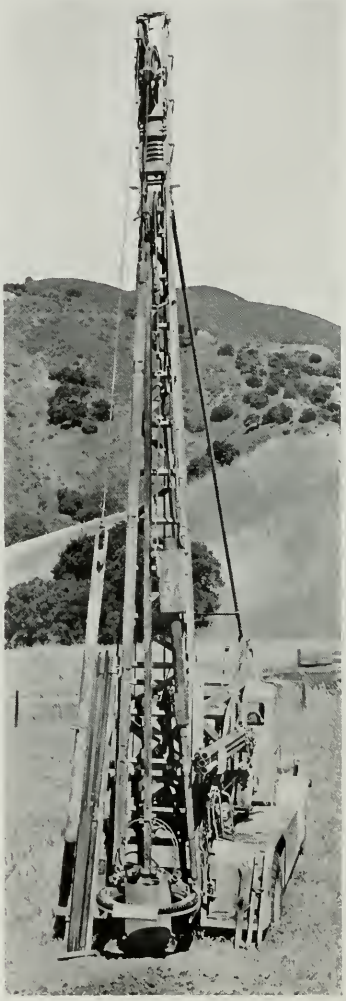
Commercial machines are usually built for only one type of drilling and the tools designed for opening a hole to water or oil bearing strata. Foundation explorations, on the other hand, must determine not only the type of material, but also its condition, in place. Special equipment and tools are, therefore, required to procure undisturbed cores for determination of moisture content, density, compressibility, and shear strength.

POWERFUL DRILL

The combination foundation exploration rig described herein was designed for churn drilling, rotary boring, and for operating the improved type soil sampler, described in "California Highways and Public Works," July, 1936.

The churn drill with a spudding beam actuates a 500-pound hammer to drive the sampler outfit and also breaks through large boulders and solid rock with regular well drilling tools. A 1500-pound string of tools with a 6-inch bit is included as regular equipment. With proper bits, eight to twelve inch holes can be opened through rock to a depth of 400 feet.

A thirty-inch rotary table is mounted on the back of the drill frame for driving a 24-inch auger bucket. Holes up to 48 inches in size may be dug with the same tool by attaching a reamer to the top of the bucket. Large diameter holes are often desired in earth and soft bedded shale formations to determine ground water conditions and the dip and nature of the strata. Undisturbed samples of large dimensions can also be obtained from any of the ground explored with such borings.



Porter rig with tools in place ready for operation

MOBILE EQUIPMENT

The rotary table is designed to operate at any speed between 5 and 50 r.p.m. and can also be used for driving Calyx type rock coring bits up to 30 inches in size. It is not contemplated that this type of drilling will normally be required and large rock core bits are not, at present, included with the tools for the outfit. The complete rotary mechanism is demountable and, when desired, can be removed from the main rig frame in thirty minutes.

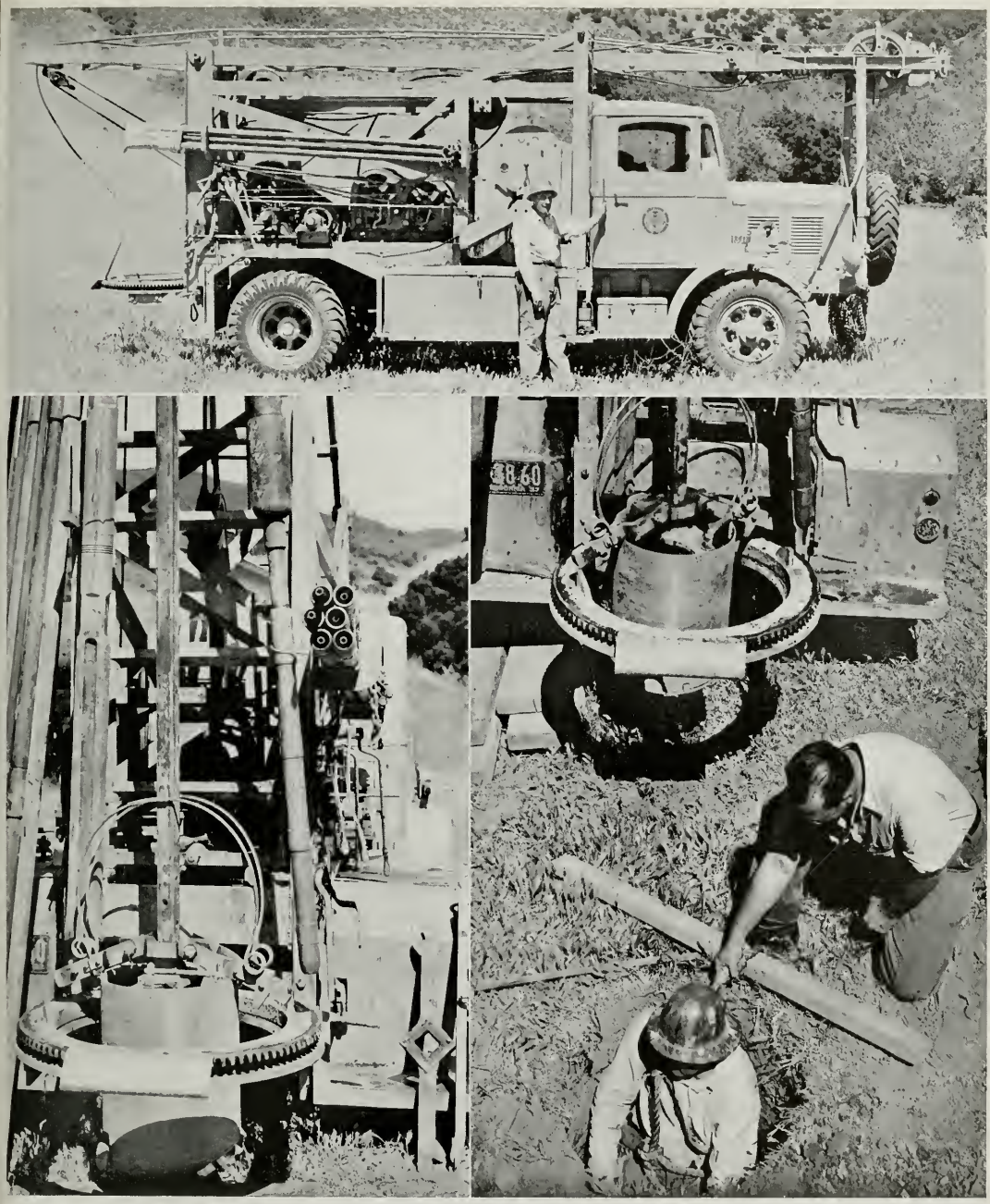
DESCRIPTION OF DRILL

All drill units are mounted in a welded box-type steel frame constructed from heavy channels. This frame is attached to the truck chassis with six heavy "U" bolt clamps, but the outfit can be quickly detached and moved onto a barge for drilling over water or skidded to difficult boring locations on steep hillsides. The equipment can also be readily rigged for driving light piles in marsh lands or river-beds whenever a temporary trestle or working platform is required to reach such inaccessible locations.

INDEPENDENT POWER UNIT

The power unit is independent of the truck and consists of a Ford V-8 motor with a five-speed truck transmission mounted in a K. R. Wilson industrial conversion unit. This provides ample power and flexibility with the gear ratios to meet all operating requirements for the various types of drill tools. A heavy

(Continued on page 28)



Upper—Combination foundation drilling equipment dismantled and ready for road. Lower left—Closeup view of rig showing sand bailer, extension rod for soil sampler, churn bit, rotary bucket with Kelly bar and driving yolk, and the sampler assembly. Lower right—Foundation inspector sitting in top of 30-foot boring following inspection of the ground to bottom of an 80-foot hole.

Another Unit of Tahoe-Ukiah Lateral Completed By State

By SCOTT H. LATHROP, Assistant Engineer

WITH the completion of construction between the Parks Bar Bridge and the Yuba-Nevada County line, another section of the Tahoe-Ukiah lateral has been brought up to present day standards of grade and alignment, enabling it to serve traffic more adequately.

This increasingly popular road extends from the Redwood Highway near Ukiah to U. S. Route 40 near Emigrant Gap. Providing as it does the most direct route between the Redwood Empire and the Lake Tahoe region, the traffic on this road is steadily increasing. In addition to the two recreational areas mentioned above, this road passes through the Clear Lake resort area in Lake County.

From Marysville to its connection with U. S. Route 40 the Tahoe-Ukiah road passes through country which is rich in historical interest, bringing to memory the "Days of '49" when "Gold!" was the magic word which brought men flocking by the thousands to the mountains of California.

EARLY MINING CAMPS

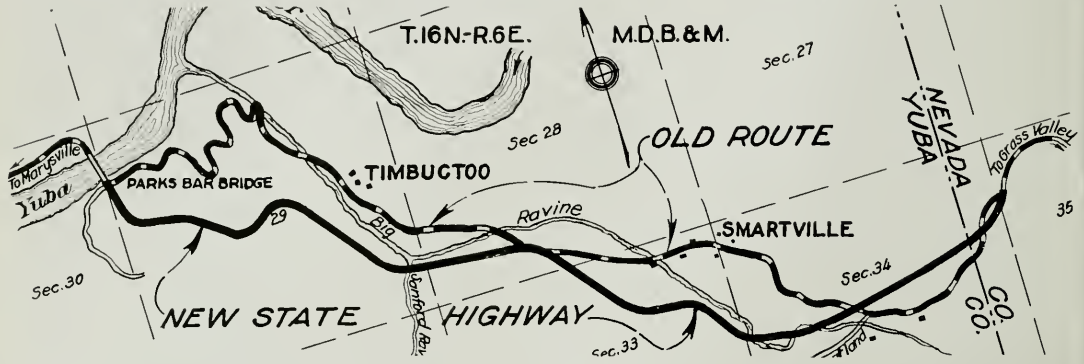
Marysville, Timbuctoo, Smartville, Rough and Ready, Grass Valley, and Nevada City are all names familiar to those interested in early California history. The gold-producing days are not all in the past either for, since the price of gold was raised, many of the old mines in this region have been reopened and gold production has increased materially. All along the Yuba River, from Parks Bar Bridge upstream, are "gold-snippers" busily panning and cradling the gravel from the river bottom for the gold which the river still brings down.

The forty-niners didn't spend much time worrying about roads and, as a result, the pack trails which later became wagon roads followed the lines of least resistance and were very likely to be replete with tortuous curves.

The section of the road between Marysville and Grass Valley, which was taken over by the State for maintenance in 1926, was developed from the old wagon road with sections where no standards of grade or alignment were observed. As a result, in many places dangerous curves and steep grades have presented constant hazards to traffic. Considerable relief has been afforded by the widening of curves and similar maintenance work, but ultimately new construction or reconstruction over the major part of the distance will be required. This is being done by stages as funds become available.

PROJECT COST $170,000

Construction of the project just completed, costing approximately $170,000, was made possible by its inclusion in the U. S. Public Works Highway Program. The newly completed unit is about 3.7 miles in length and extends from the bridge across the Yuba River at Parks Bar, which is approximately sixteen miles from Marysville, to one-quarter of a mile east of the Yuba-Nevada County line.



At this point it connects with a section of the road which was brought up to standard width, grade, and alignment in 1932.

The recently completed construction consisted of grading the roadbed, placing crusher run base, and applying a seal coat over the full width of the crusher run base. In addition to providing customary drainage facilities to care for an average annual rainfall of about 35 inches, it was necessary to provide several special structures for crossings of irrigation and mining ditches belonging to the Nevada Irrigation District.

GOLD DIGGINGS UTILIZED

Rock for the crusher run base course was crushed locally by the contractor, being secured from a hydraulic spoil bank near the center of the project. It is interesting to note

that material which was cast aside by men in the frantic search for gold is now being utilized to construct a road over which people will travel in search of intangible scenic riches.

The alignment on the new construction complies with present day standards for mountain roads. The improvement in alignment over the old road is very noticeable when it is remembered that many of the old curves had radii as short as 50 feet. In addition to being very sharp, many of these curves were "blind," presenting a very definite menace to traffic. Among the worst curves to be eliminated was the right angle turn at the east approach to the Parks Bar Bridge.

MAXIMUM GRADE 7 PER CENT

The maximum grade on the new project is 7%, the total rise being approximately 700 feet in a distance of about 3.7 miles. The rise in elevation is constant throughout the project, adverse grade being required at only two locations. This is in contrast to the old grade line which contained several pieces of adverse grade of various lengths and several grades of considerably more than 7%, the steepest being one of about 15%.

The length of the improvement is 3.71 miles with a saving in distance of 0.6 of a mile over the old route.

Since the road was opened to public traffic in June many favorable comments have been received, from which it may be concluded that it is adequately serving the traffic which travels this route.







Construction of realigned highway between Parks Bar Bridge and point one-fourth mile east of Nevada County line eliminated such poor alignment as shown in upper photograph. Center—Showing how new highway approaches bridge with safe sight distance and curve. Lower—Section of newly completed highway.

Future State Highways Will Be Made Wider

(Continued from page 1)

for the adaptation of existing pavement to the ultimate design of divided roadway. In these designs provision is made for the full use of existing roadway and pavement and for the progressive development to a greater capacity leading toward the ultimate section, with a minimum loss or waste of what already has been installed.

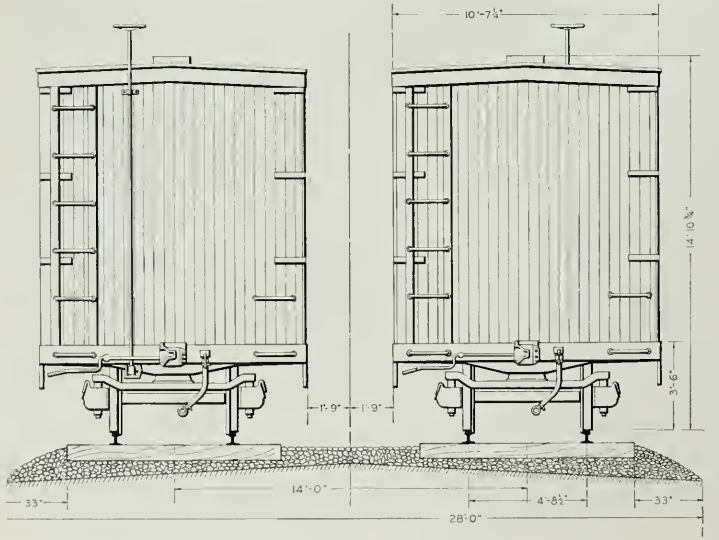
The designs include three-lane roads using the new standard width of lane. These three-lane roads are being built to make them easily adaptable to future expansion into the divided type. This design consists of building two lanes of permanent pavement separated by an intervening lane of lighter type construction. The middle lane can then be converted into a dividing strip without appreciable loss and will serve in the meantime as a traffic lane for passing until traffic volume requires the increased capacity. This type of construction, characterized by the contrasting color of the separate lane, has a decided controlling effect on the operation of vehicles since it definitely demarks the separate lanes in which they are to travel.

MINIMUM WIDTH FOR STRIPS

A minimum width of four feet has been adopted for the separation strips on the divided roadway. This width is the least which can provide adequate clearance and safety against hazard for vehicles traveling in opposite direction. It will be applied on many of our multiple lane roads since it conserves space and can be installed in adapting existing pavement to the divided type with less loss of existing pavement. In many cases, too, it will not require additional width of right of way, which would be expensive especially where considerable improvement of adjacent property has occurred.

This minimum width of separation strip requires some positive means of

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This sketch of two standard freight cars shows a clearance between cars of 3 feet, 6 inches. Even though these cars are on immovable tracks, railroads consider this clearance a necessary safety precaution.

New Foothill Boulevard Will Be Four Lanes

By E. Q. SULLIVAN
District Engineer

WORK has started on widening the Foothill Boulevard between Claremont and San Bernardino. A contract was awarded on July 9, 1937, in the amount of $369,453.10 to the United Concrete Pipe Corporation.

The specifications provide that traffic shall not be interrupted during the progress of the work, and the contractor is planning his operations to conform to this requirement.

Seven years ago, the original two-lane highway was widened to three lanes and it has served well until the present time. The greatly increased traffic and the high speed of modern automobiles has now made mandatory widening to four lanes. Conforming to modern practice, a center dividing space will be constructed to provide greater safety to motorists.

The Foothill Boulevard is known throughout the entire United States. Seven years ago, at the time of the widening to three lanes, articles appeared in many National magazines, with illustrations showing the rows of palms, orange trees and eucalyptus trees.

There are miles of eucalyptus trees that exceed 100 feet in height and some reach a height of 200 feet. Eucalyptus trees, palm trees, and orange trees border the highway for almost the entire length of the boulevard.

For more than sixty miles, the Foothill Boulevard follows along the base of the San Gabriel Mountains, including Mt. Lowe, Mt. Wilson, Mt. San Antonio, Mt. Cucamonga. These towering, rugged peaks rise abruptly from the valley floor to the north of the highway. For the last thirty miles, the Foothill Boulevard points directly east at Mt. San Bernardino. In driving easterly, Mt. San Bernardino is framed between the orange trees, palm trees and eucalyptus trees; and together with the San Gabriel Mountains, it is covered with snow from December until June, providing an excellent tourist attraction.





Upper—Foothill Boulevard west of Sierra Way. Palm trees on the left will be moved back and eucalyptus trees on right will remain undisturbed. This stretch will be widened and repaved. Lower—Artist's conception of how this section of boulevard will look after improvement.

Drivers Increasing

More than 23,000 original operators' licenses were issued in July, to applicants in California, Paul Mason, Chief of the Division of Drivers' Licenses, has reported to Governor Merriam.

"This number," Mason said, "represents twenty-nine per cent of all applications issued by the division for the month and apparently indicates that the number of persons learning to drive and the number of nonresidents entering California are steadily increasing."

Angeles Crest Highway Opens Vast Recreational Territory

By S. V. CORTELYOU, District Engineer

COMPLETION of the Crow Brothers contract for the United States Bureau of Public Roads this month, and completion simultaneously of that section constructed by the Division of Highways with prison labor, will mark the opening of vast areas of the 645,000 acres comprising the Angeles National Forest, making them easily accessible to the motoring public for the first time.

Heretofore, the only roads of a public nature to this potential recreational area, were Forest Service truck trails, twelve feet wide, constructed for fire protection measures. Approach to the mountain areas by the public on these trails could be made only from the Mojave Desert side.

Construction of mountain highways is greatly appreciated by the public for the scenic, inspirational and recreational assets, as indicated by the increase in the volume of mountain-bound traffic during the last ten years.

YEAR AHEAD OF SCHEDULE

Opening of the newly completed stretches of the Angeles Crest Highway at this time, approximately a year ahead of schedule, has been made possible through the close cooperation of the United States Bureau of Public Roads and the Division of Highways. The United States Forest Service has future plans for the development of camping facilities that will afford the residents of Southern California a vast new mountain recreational area.

From Red Box, the present terminus of the Angeles Crest Highway, so named because in past years a large red box there housed fire-fighting materials for forest rangers, the new highway proceeds north and northeasterly for a distance of 9.3 miles to Charlton Flat, reaching an elevation of 5200 feet. Red Box is also the junction point of the new high gear road bearing off southeasterly to the Mount Wilson observatory of the Carnegie Institute, famous throughout the world.

NATURAL FOREST LANDS

Charlton Flat is an area of natural forest park lands some 600 acres in extent, for which the United States Forest Service has plans to begin work within the next year on the development of the area into one of the largest and finest camp and picnic grounds in the Angeles National Forest. There are large pine trees located throughout this level terrain, grassy meadows, and several excellent springs which will be developed to provide an abundance of water.

The Angeles Crest Highway sections to be opened to the public, from Red Box through Charlton Flats, and extending in a general northeasterly direction to Chilao, where they will dead-end at the Newcomb Ranch, were surveyed and the location made by the United States Bureau of Public Roads in 1934-35. The standards of construction on the newly finished sections are the same as those of the high gear Angeles Crest Highway between La Canada and Red Box.

SPIRAL CURVES USED

An engineering feature of the new construction is the use of spiral curves instead of simple curves. All sections of the highway are graded to a uniform roadway width of 30 feet. Maximum grade is held at 6 per cent, compensated for curvature. Cut slopes are 3/4:1, excepting in the heavier rock sections where slopes are steepened to 1/2:1.

That portion of the highway 2.92 miles in length, completed by the Division of Highways with prison labor, involves the heaviest grading of the newly completed sections of Angeles Crest Highway. Cuts measured on center line run as deep as 140 feet, and in one side hill cut the distance from roadway to top of cut is 240 feet. The total yardage moved in construction of the 2.92 miles was 1,002,000 cubic yards, the work being completed at a total cost of $450,000 or an average of $154,000 per mile. Approximately 90 per cent of the excavated material was rock, requiring heavy shooting.

EMBANKMENTS EXTRA WIDE

Embankments were constructed by the end dump method and built out to extra width. As the natural repose of the embankment material is approximately 1.3 to 1, the fill slopes were flattened out to secure added stability to a 1½ to 1 slope by employing a double drum hoist operated along the roadway shoulder section connected with a "dead man" at the toe of fill operating a ½ cubic yard scraper bucket. Rapid progress was made with this method resulting in a fill slope uniform in appearance, with all loose rocks moved, and affording an excellent surface for the erosion control to be applied.

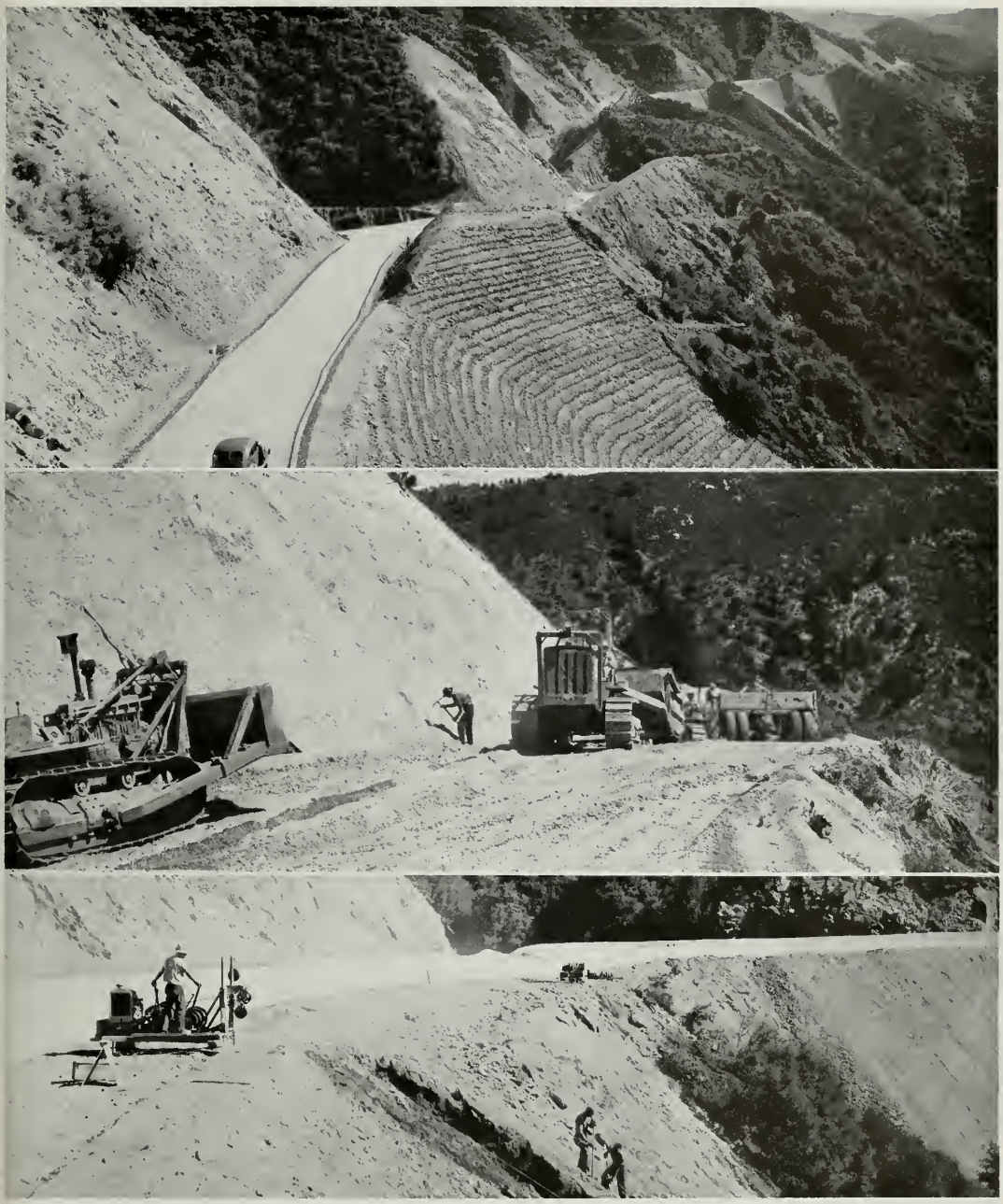
Erosion control treatment has been carried on throughout the entire project and on this job it consists of longitudinal wattling of stakes and brush to mechanically anchor the fill surface. This surface, so treated, is then planted with cereal grains, followed by a covering of bedding straw, the latter serving as protection for the seeds against washing out by the winter rains.

EROSION CONTROL

This erosion control method has been developed during the past several years by the California Forest & Ranger Experimental Station, conducted by the United States Bureau of Public Roads, and has proven most successful under a variety of conditions.

Construction work has been carried out progressively since completion in 134 of the Angeles Crest Highway as far as Red Box. The Thompson Construction Company, Guy F. Atkinson, and Crow Bros., have each under-

(Continued on page 19)



Scenes on Angeles Crest Highway. Upper—Section of new highway showing erosion control treatment applied to fill slopes. Center—Typical grading operations on highway near Chilao, ten miles northeast of Red Box. Lower—Illustrating method of flattening fill slopes prior to applying erosion control treatment.

State Highway Commission Observes 25th Anniversary

By T. E. STANTON, Materials and Research Engineer

SITTING for the first time in its spacious board room in the new Public Works Building in Sacramento on July 2, the California Highway Commission celebrated the twenty-fifth anniversary of its existence as a State agency.

The year 1937 marks the twenty-fifth anniversary of active construction and development of the California State highway system. It was early in 1912 that the first California Highway Commission, composed of Burton A. Towne, Chairman, N. D. Darlington and the late Charles D. Blaney, acting under authority of the First Highway Bond Act of 1909 set up the organization and began the active work of surveys preparatory to construction on the State system as provided under the bond act.

Highway development has made rapid advances during the quarter century and the evolution of road construction practice for motor transportation to modern high standards presents a most interesting story. Of equal interest is the growth of public interest and concern for highway matters to the present universal realization that adequate road facilities are of utmost personal importance.

FIRST HIGHWAY STEP IN 1895

First definite action toward a State highway system in California was taken in 1895 when, by act of the legislature, the State Bureau of Highways was created to acquire and construct State roads. Under authority of this legislative action the Governor appointed R. C. Irvine of Sacramento, Marsden Manson of San Francisco, and J. L. Maude of Riverside to serve as members of the Bureau.

With a buckboard and team Irvine and Maude drove over 7000 miles into every county of the State, traveling along the coast, through valleys, mountains, and desert. As a result of this reconnaissance a report and map of a proposed and recommended State highway system was submitted to the Governor on November 25, 1896.

It is of interest to note that the system then proposed was in its main features the foundation of the State highway system as it exists today.

FIRM FOUNDATION

The 1897 legislature dissolved the Bureau of Highways and created a Department of Highways to which Marsden Manson, J. R. Price, and W. L. Ashe were appointed to serve as commissioners for a period of two years. The members of this new department bent their efforts in exhaustive studies of road construction practices and economics.

Mr. Manson made a tour of Europe to observe construction methods followed in England, France, Germany, Russia and other countries. Their findings on drainage, roadbed and pavement construction were based on fundamental engineering principles so that in its early beginnings highway development in California was placed upon a firm foundation.

As the result of the work of these pioneers of modern road construction, an amendment to the California State Constitution was adopted on November 4, 1902, giving the legislature power to establish a system of State highways and to pass all laws necessary for highway construction and maintenance.

GOOD ROADS SENTIMENT

In 1907 the Department of Engineering was established but, because of the lack of funds, any material progress in road construction by this department was prevented.

During these preliminary years favorable public sentiment for "good roads" was spreading throughout the nation and with the rapid rise in manufacture and sale of motor cars during the first decade of the century this sentiment crystallized into action.

At the general election in 1910 the voters of California gave their approval to an act passed by the 1909 legislature for the issuance of State bonds amounting to $18,000,000 for the purpose of acquiring and constructing a State highway system.

FIRST BOND ISSUE

The act of 1909 providing for the first bond issue made possible the real beginning of a unified system of State highways and with the appointment of three members to the first California Highway Commission, under authority of legislation enacted in 1911, the nucleus of a State organization provided with authority and funds for construction of such a system began to function.

The act specified the routes to be included in the system should constitute a continuous and connected network of highways with arterials running north and south traversing the Sacramento and San Joaquin Valleys and along the coast, together with lateral roads, so that the several county seats, centers of population, and main transcontinental routes entering California would be joined by State highways.

The three members of California's first Highway Commission, Mr. Towne, Mr. Darlington and Mr. Blaney assumed their responsibilities without hesitation and together with Austin B. Fletcher, whom Governor Hiram Johnson appointed to the post of first State Highway Engineer, began the task of establishing a department to develop the system as dictated by the bond act. The State was divided into seven districts and an experienced engineering staff organized to carry on the work.

FIRST EARTH TURNED

The commission and Mr. Fletcher toured the State from the Oregon line to the Mexican border, traveling some 6,800 miles and making an intensive study of the highway needs of the State as a whole. Upon the basis of



Members first State Highway Commission appointed August 9, 1911. Left to right—Burton A. Towne, chairman; Chas. D. Blaney, N. D. Darlington.



Present Highway Commission: Julien D. Roussel, secretary; Wm. T. Hart, Paul G. Jasper, Harry A. Hopkins, chairman; H. R. Judah and Philip A. Stanton.

geographical controls and the stipulations of the bond act, improvement projects were selected and surveys begun in preparation for construction.

In less than one year after the beginning of work more than 1,000 miles of State highway had been surveyed and on August 7, 1912, Mr. Towne turned the first shovel of earth on California State Highway Contract No. 1, to start construction of an asphalt concrete pavement on a section of the Coast Route between South San Francisco and Burlingame, in San Mateo County. Since that date, highway construction, reconstruction, improvement and maintenance have been continuous upon the State system.

The efforts of the first highway commission laid a firm foundation for highway improvement and development and succeeding commissioners have held to the high standards of public service which these pioneers in the highway field inaugurated.

PUBLIC DEMAND INCREASES

Rapid expansion of the automobile industry and the great increase in the use of motor cars and trucks created an insistent and active public demand for increased highways, which necessitated additional funds for the work.

In 1913, the State legislature passed an act requiring registration of all motor vehicles which provided for the equal division of the net revenue from the registration fees between the State and the counties and stipulated that the State's share be devoted to maintenance of highways.

At the 1916 election the voters ratified the Highway Act of 1915 providing $15,000,000 for continuation of the work being performed with funds provided by the first bond act.

As the work proceeded and cars on the highways increased in numbers it became evident that required facilities would necessitate still further funds and at a special election on July 1, 1919, a third bond issue of $40,000,000 was ratified by Californians.

It likewise became evident that future financing of State highway construction by issuance of bonds would create a burden which was too great for the State to bear and in the biennial report of the Highway Commission for 1919-1920 recommendation was made for the imposition of a gasoline tax, the proceeds of which should be devoted solely to highway purposes.

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Shade Trees Are Preserved Along Realigned Road

By R. M. GILLIS, District Engineer

ELIMINATION of four railroad grade crossings, the saving of over one mile in distance and construction designed to preserve shade and ornamental trees along the realigned highway featured the improvement of State Route 129 in Tulare County extending from the town of Strathmore through Lindsay to Cairns Corner.

Relocation of this road carrying over 2000 cars a day avoided two grade crossings of the Visalia Electric Railway and two crossings of the Santa Fe and, as shown in the pictures on this page, was done in such a way as not to destroy the beautiful trees lining the highway. The upper photograph is of a stretch between Exeter and Lindsay and the lower is of a section between Lindsay and Cairns Corner, both showing the preservation of shade trees.

The project completed by N. M. Ball Sons and Larson Bros. at a cost of $155,000, provides an eighty-foot right of way graded to its full width and surfaced with a twenty-foot pavement with eight-foot oil mixed shoulders on each side.

Compared with the old sixteen-foot pavement with narrow right of way and sight distance limited by orange groves at the road intersections and railroad crossings, this improvement offers a very substantial contribution to traffic safety, for the two thousand vehicles that use it daily.

Route 129 starts at Famoso, twenty miles north of Bakersfield on Route 4. It serves not only as the route from the south to the rapidly developing recreational areas of Sequoia and General Grant Parks, but also is the main traffic artery for the prosperous agricultural district through which it passes. Because it is through the center of Tulare County's rich citrus orchards, it has been appropriately given the local name of Orange Belt Highway.



Conceited Wife — Darling, doesn't my beauty seem unreal to you at times?

Husband—Yes, especially when I look at the jars on your dressing table.

34 California Counties Get Federal Aid for Local Roads

By GEORGE T. McCOY, Assistant State Highway Engineer

THIRTY-FOUR California counties are to receive direct benefits during 1937 and 1938 for construction on approximately 250 miles of county roads, estimated to cost $1,650,000. Improvements to be made under this program will be financed from Federal funds apportioned to California supplemented by county funds.

Included in the amendment by Congress of the Federal Aid Highway Act in June, 1936, was not only the continuation of regular Federal aid for State highway work in the several states, but also provision for Federal assistance in the improvement of feeder highways. The funds for this last purpose were authorized for appropriation in an amount of $25,000,000 for each of the fiscal years ending June 30, 1938, and 1939. The apportionment to the states of the 1938 funds allocated $971,644 to California.

MATCH FEDERAL FUNDS

The work will be carried on cooperatively between the counties, the State Division of Highways and the U. S. Bureau of Public Roads, with the direct supervision under the State Highway Department. The Federal funds will be matched by county money.

Rules and regulations governing the administration and expenditure of these funds which were promulgated by the United States Bureau of Public Roads early this last spring, were given intensive study by the Division of Highways before proceeding with the formation of the feeder road construction program to be financed with this Federal money. The regulations clearly indicated the intent of the government to provide improvement to so-called "farm to market" and "mine to market" roads of a distinctly rural character which feed from rural communities to an improved highway system.

Although the rules and regulations specified that the money provided by the government for this feeder road program be expended on rural highway construction in at least 50% of the counties of a State and that at least 30% of the funds be spent on projects located off the State Highway System, the California Highway Commission at its meeting on June 17, 1937, approved distribution of the apportionment to California to approximately 60% of the counties of the State and expenditure of the entire apportionment on county roads not a part of the State Highway or Federal Highway Systems.



GEORGE T. McCOY

This policy of using the entire apportionment on county roads was determined after conference with county authorities on the feasibility of such a procedure based upon tentative allocations to the various State highway districts.

On March 18 a joint meeting of County Engineers and Engineers of the Division of Highways was held in Sacramento. At this meeting the program was discussed in detail and lines of action determined. That the various counties were anxious to avail themselves of this Federal assistance for improvement to county roads was evidenced by their submission of proposed projects over-subscribing the available amount by nearly 100%.

Selection of the projects was made by the Division of Highways Engineers in cooperation with local authorities. The accompanying program of projects has been approved by the U. S. Bureau of Public Roads for expenditure from the 1938 funds; preparation of the projects is well adavneed; and advertising for bids on contracts will be under way in a week or two.

HIGHWAY PLANNING SURVEY

It is the plan of the Federal Government to establish Federal aid feeder highway systems in the various States in addition to the existing Federal Aid Primary and Secondary road systems. There is now under way in California an exhaustive highway planning survey under the direction of the U. S. Bureau of Public Roads. From the data collected in this survey it is hoped to establish the highways, satisfactory to counties, State and Federal government, for inclusion in such a Federal feeder system and to lay out a general program of systematic improvement in the order of greatest need.

(Continued on page 14)

Proposed California Federal Aid Seconda

In the administration of the Federal feeder road funds for the years ending June 30, 1938, and 1939, California ha officials, will in all probability be included in the proposed feeder road system when the planning survey is completed.

Road	Location
Del Norte—Talowa Creek Road	Tryon's Corners (Rte. 71) west to Lower Lake Road
Humboldt—Eight sections adj. Rte. 56	Various Roads near Ferndale
Lake—Lucerne Cut-off	Rte. 89 to Rte. 15
Mendocino—Longvale Dos Rios Feeder	South Fork Eel River
Lassen—Bieber Hackamore Road	Bieber Rte. 28 to Modoc County Line
Lassen—West Janesville (Rte. 29)	Near Wendel to near Edgemont (portions)
Plumas—Vinton-Loyalton Road	Vinton Rte. 21 to Sierra County Line
Siskiyou—East Side Scott Valley	Portions Fort Jones (Rte. 82) to Callahan
Butte—Richvale-Gridley	State Rte. 45 to Biggs
Butte—Clark Road	One to 6½ miles S. Paradise
Glenn—Elk Creek to Willows	6.9 mi. to 10.5 mi. W. of Willows
Sacramento—Antelope	Ben Ali to 3.6 Nly. (Walerga)
Sacramento—El Centro Road	Natomas levee (near American River Mouth) to 5.6 mi. Nly.
Yolo—Elk Slough	Opposite Courtland
Yolo—Bachinnis Corner to Sacramento River Road	1.5 Mi. N. Rte. 87 W. Knights Landing to Rte. 88
Yolo—Grant Line Road	Near Esparto to near Yolo
Alameda—Mt. House Road	State Rte. 5 Nly. to S. P. R. R.
Marin—Manor-Pt. Reyes Road	Fairfax to 3.4 miles northwesterly
Napa—Silverado Trail	Portions Calistoga to near Oakville
Santa Clara—Uvas Road	N. Line Uvas Ranch to Croy Road
Monterey—Arroyo Seco	Line change 5 miles west Greenfield
San Luis Obispo—Corbit Canyon	Arroyo Grande to Rte. 147 near Edna
San Benito—King City-Bitterwater Rd.	Bitterwater (Rte. 119) to County Line
San Benito—North Pacheco School	Pacheco Creek
Santa Barbara—Guadalupe-Lompoc Road	Near Guadalupe to Casmalia
Fresno—Goodfellow Avenue	Over Kings River South Sanger (Hanke Bridge)
Kern—Weed Patch-Wheeler Ridge Road	Rte. 4 to Rte. 140
Kern—Allen Road	Rte. 58 South to Bellevue Road
Kings—Hanford-Kingsburg	Hanford North 6.5 miles toward Selma
Madera—Howard and Wilson Roads	Madera West to Firebaugh Road N. S. thereof
Madera—Washington Boulevard	Chowchilla West to Chowchilla River
Ventura—Camarillo Road	Rte. 2 near Camarillo East to near Rte. 155
Ventura—Santa Clara Avenue	Rte. 2 East of El Rio to Central Avenue
San Bernardino—Various Streets	Waterman Ave. (San Bernardino) S. Ely. to Colton Ave. (Rte. 26)
San Bernardino—Bloomington Diagonal	S. Rialto (Rte. 26) to Bloomington
San Bernardino—Cedar Avenue (Bloomington)	Colton to Slover Avenues
San Bernardino—Base line Road	Citrus to Linden Avenue
San Bernardino—Base line Road	Cactus to Meridian Avenue
Riverside—Mockingbird Canyon	South City Limits Riverside to Cajalco Rd.
Riverside—Palo Verde Road (Avenue 24)	Ripley (Rte. 146) East to Colorado River
Inyo—Trona Road	Nly. San Bernardino Co. line to Rte. 127 in Panamint Sink
Amador—Sutter Cr.-Volcano Road	Sutter Cr. (Rte. 65) to Volcano
Amador—Plymouth-Fiddletown Road	Plymouth (Rte. 65) East to Fiddletown Br.
Calaveras—Mokelumne Hill-West Point Rd.	So. Fork Mokelumne River to Herberts Ranch
Calaveras—Murphys-Sheep Ranch Road	Near Murphys (Rte. 24) N. to near Sheep Ranch
Calaveras—Eugene-Milton & Rock Cr. Rds.	South and S. E. Milton
Merced—South Planada	8 Roads near Planada
San Joaquin—Mosley Road (W. Lodi)	Terminous Rd. (Rte. 53) N. to Peltier Rd. (portion)
San Joaquin—Bacon Island Road	Middle R. Ferry to Mandeville Island Ferry
Stanislaus—Merced-Port Stockton Road	Tuolumne R., Bet. Empire (Rte. 110) & Hughson
Imperial—Westmoreland Road	New River to 2 Mi. W. Calipatria; South to 2 Mi. W. Brawley
San Diego—Valley Center to Rincon (Rte. 195) Road	Over San Luis Rey River
San Diego—Highland Avenue	S. National City across Sweetwater River
Highway Planning	

Projects To Be Financed With 1938 Funds

ranted considerable latitude in the selection of projects, which, in the opinion of State Highway Engineer and county ing is the program for county road building as finally approved:

Length miles	Nature of improvement	Estimated cost
2.0	Grade, Base, armor coat	$5,000
12.5	Grade, base	22,500
2.4	Grade, Bit. surfacing	10,000
	Bridge	47,000
4.1	Grade, base, bridges	10,800
3.6	Grade, base, bit. surfacing bridges	15,200
8.0	Grade, base, bit. surfacing	61,600
5.6	Bituminous surfacing	22,400
3.8	Grade, base, armor coat	26,000
5.5	Grade, base, armor coat	56,500
3.6	Base and Bit. Tr. surfacing	23,300
3.6	Grade, base, armor coat, bridge	90,000
5.6	Base, armor coat	87,000
	Bridge	9,000
3.75	Grade, base, oiling	18,000
8.5	Bit. tr. surfacing, R. C. box culvert	21,500
4.1	Grade, base, bit. surfacing	59,800
3.4	Grade, 20' A. C.	95,700
6.6	Grade, drainage & dust oil	65,000
3.9	Grade and bit. tr. surfacing	75,000
0.4	Grade, culverts, seal coat	35,000
7.0±	Bit. tr. surfacing & armor coat	13,300
5.0	Bit. tr. surfacing & armor coat	12,000
	Bridge	8,000
8.0	Grade	70,000
	Bridge and approaches	80,000
17.4	Grade, surface, structures	33,830
2.0	Grade, oil, and bridges	10,270
6.5	Grade, A. C., oil shoulders	82,200
10.5	Grade and oil	10,500
7.0	Grade and oil	7,000
4.0	Grade and bit. tr. surfacing	25,000
1.5	Grade, bit. tr. structures	25,000
4.0	Bit. tr. surfacing	12,000
2.2	Bit. tr. surfacing	7,000
0.5	Bit. tr. surfacing	2,000
3.0	Bit. tr. surfacing	9,000
2.0	Grading, Bit. tr. surfacing	8,000
4.75	Grade, base, bit. tr. surfacing	35,000
3.5	Grade, Bit. tr. surfacing, bridges	30,000
32.0	Grade and oil	50,500
12.3	Untr. Gravel surfacing	10,420
5.5	Bit. surf. treatment	5,100
1.8	Base and surfacing	5,600
5.2	Grading	6,000
5.0	Bit. tr. surfacing	5,300
	8 bridges	32,000
4.25	Grade, base, oil, seal	38,000
5.5	Grade, base, oil, seal	28,000
	Bridge	12,000
23.6	Base, Bit. tr. surfacing	34,300
	Bridge	35,000
	Bridge	60,000
		25,128
Total		$1,683,748

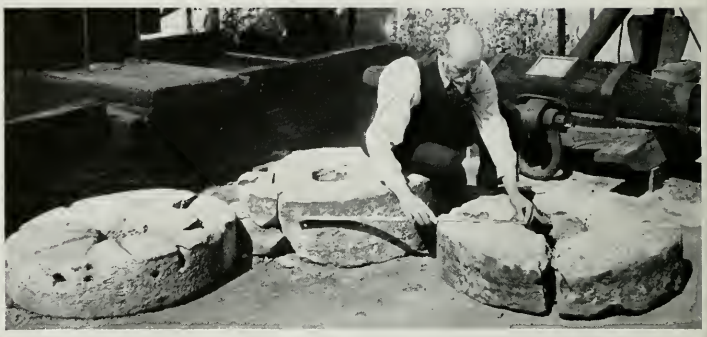
Relics of Pioneer Days Found By State Highway Engineers

By GLENN B. ASHCROFT, Senior Structural Engineer
Division of Architecture

SUTTER'S Fort Historical Museum in Sacramento has been enriched by a gift from the State Division of Highways of four old burrstones of ancient manufacture which were installed in a crude powder mill erected at Towle in Placer County in 1888.

For many years, these millstones lay on the site of the factory, which was destroyed by fire several decades ago. When the State highway between Sacramento and Truckee was rerouted in the vicinity of Towle, engineers of the Division of Highways discovered the burrstones and, their curiosity aroused, reported their find to headquarters.

I had the pleasure of delving into the history of these relics of pioneer days. Old-timers at Towle said it generally was believed the burrstones had been brought to California from France. Close examination of them shows that they are composed of a very peculiar flinty material the like of which I have never seen in any of my travels about the State, but of course this does not prove that such stone is not to be found somewhere hereabouts. It is possible the stones did come from France.



Curator H. C. Peterson of Sutter's Fort Museum assembling historic burrstones presented to him by Division of Highways.

PRESENTED TO MUSEUM

H. C. Peterson, curator of Sutter's Fort Historical Museum, was notified of the discovery of the stones and at his request the Division of Highways transported the relics to the museum.

Four burrstones believed to have been used in a wood-pulp mill built by the Towle brothers in 1880 are thought to be buried under the highway fill at Towle and may be excavated some time in the future.

The story of the pulp mill and its successor, the old powder mill, is rather interesting.

Some sixty years ago the Towle Brothers were actively engaged in the lumber business in Placer County, with headquarters at a small town named "Towle," now merely a station stop on the Southern Pacific Railroad running from Sacramento to Truckee.

MILL ERECTED IN 1880

About the year 1880 these brothers in company with other interested parties erected a mill on the side of the canyon a short way below (southerly) and a short distance westerly from the present location of the railroad company's water tank at Towle station.

The purpose of this mill was to make crude wood-pulp to be used in the manufacture of paper, and the way it did so was substantially in this manner: A large single stone of disc form several feet in diameter and having a thickness of some two feet was mounted rigidly upon an iron shaft which was driven by a Pelton water-wheel.

The circumferential face of this stone was cut into small, transverse, parallel grooves producing a wide grinding surface quite comparable in texture to the surface of an ordinary domestic "washboard." The stone was enclosed in a metal housing into which a stream of water was fed and through an opening in which small blocks of tamarack timber were forced against the fluted face of the rapidly revolving stone and soon reduced to a form of crude pulp which passed out through another opening in the housing and thence through a set of rolls which formed it into a large sheet, or "blanket."

This blanket was then folded together, shipped to San Francisco, there put through a refining process, and eventually became the finished product (paper).

This plant, which was known in the early days as the "Pulp Mill," was operated for a period of approximately eight years, then closed down and never used again.

POWDER MILL BUILT

At this time a second mill, which was later to become known as the "Powder Mill," was erected alongside the abandoned pulp plant. Its purpose was to utilize the waste sawdust from Towle Brothers' nearby box factory, and produce a product suitable for use in the manufacture of blasting powder and dynamite.

For this process stones, essentially of the "burrstone" type as used in

flour mills at that time, were employed, and a complete assembly consisted of two such stones one of which was securely fastened into a stationary iron frame while the other one was rigidly attached to a shaft which was driven by a Pelton waterwheel. The two stones, which were mounted so that the grinding faces were parallel to and nearly in contact with each other, were enclosed in a metal housing.

Through an opening in this housing and a hole through the stationary stone at its center a worm-screw conveyor attached to the shaft carried the sawdust to the grinding surfaces where it was rapidly reduced to an almost impalpable powder and then conveyed to a blower which forced it through a silk screen having 6400 openings to the square inch. The finished product was then sacked and shipped to the powder manufacturing companies in the San Francisco Bay region.

STONES FROM FRANCE

The process generated much heat; the stones became very hot and sometimes cracked. The dust which escaped and floated about the plant was highly inflammable, and it is said that numerous fires occurred. Although the statement has not been verified, it is said that the burrstones for this mill were brought originally from France.

The "Powder Mill" continued to operate for some twelve years, until the Towle Brothers closed down their box factory which was the principal source of supply for raw material, and after that both mills remained intact until the recent "world war," when, because of increasing value of old metal, junk collectors wrecked the machinery and hauled it away. Shortly thereafter what remained of the buildings was destroyed by fire, and when still later the State highway through Towle was rerouted to its present location it cut directly through the mill site and final destruction was complete.

The only vestiges then left were the "stones" some of which were buried deep beneath the highway fill at that point and others were scattered about the neighboring hillside and half buried by debris. As if to add insult to injury some person (not known, but surmised to have been some wandering "prospector") drilled holes into such stones as were still visible and intact and broke them into pieces. Luckily he was disappointed in his quest, and it is yet possible to restore some of them to a semblance of their original condition.

COLOR FILM OF HIGHWAY GIVEN COMMENDATION

LINDSAY PUBLISHING CO.
140 East Honolulu Street
Lindsay, California
Sept. 2, 1937

Mr. C. H. Pucell,
State Highway Engineer,
Department of Public Works,
Sacramento, California.

Dear Mr. Purcell:

I am this evening forwarding to you at the above address four reels of films, "California Highways" which were shown at noon today to members of the Lindsay Kiwanis club. The pictures were shown in the Lindsay Theatre, immediately following the service club luncheon. Wives and friends of Kiwanians also were present.

Before adjourning to the theatre Mr. R. M. Gillis, district engineer, Fresno, gave a brief but informative and interesting talk on some of the problems and activities of the California Highway Department. His talk served as an excellent introduction to the picture.

The picture itself was marvelous, and all afternoon I have been receiving favorable reactions. It gets over a story that needs to be told, in a most fascinating manner. The scenes were beautiful; almost inspiring to any Californian. One man this afternoon said: "I'd be glad to pay money to see a picture like that."

The Division of Highways, Mr. Earl Lee Kelly, and you, are to be congratulated on this picture, the evidence of remarkable achievements it portrays, and the vision of the job it gives to all of us. You certainly need not be backward in presenting this film anywhere.

Sincerely,
(Signed)
FORD A. CHATTERS

Auto Traffic On Bay Bridge In August Lessens

DECREASE in number of automobiles and increase in freight poundage featured August traffic on the San Francisco-Oakland Bay Bridge, according to Director of Public Works Earl Lee Kelly. The report was compiled from figures submitted by State Highway Engineer C. H. Purcell.

A total of 853,579 vehicles crossed the structure during the 31 days of August, Mr. Kelly said. Of these, 807,670 were passenger automobiles. These figures compare to a total number of vehicles of 886,054 for July and a total number of passenger automobiles of 839,231 for that month.

"These figures do not give a full picture of August losses in vehicular traffic," Mr. Kelly said. "The seasonal curve indicates that during this month the Bay Bridge might have expected the total traffic to have approached almost one million vehicles. This amounts to an actual financial monthly loss of approximately $50,000 to the Bay Bridge due to ferry cut-rate competition."

FREIGHT INCREASE

On the other hand, the number of freight pounds amounted to 69,082,335 greater than any previous month. Trucks showed, however, a drop from 28,436 in July to 27,737 in August. There was an increase in the number of buses crossing the span, with 9,833 for August. Decreases in other types of traffic were also reported.

The total income for the month of August was $453,213.40, Mr. Kelly announced, with a daily average of 27,535 vehicles crossing the span.

COMPARATIVE FIGURES

August figures with July comparisons follow:

	Total August	Total July
Passenger Autos	807,670	839,231
Auto Trailers	2,460	2,726
Motorcycles	3,691	3,716
Tricars	780	824
Trucks	27,737	28,436
Truck Trailers	1,408	1,302
Buses	9,833	9,819
Total Vehicles	853,579	886,054
Extra Passengers	209,620	209,971
Freight Pounds	69,082,335	68,409,499

Safer State Highways Planned for Future

(Continued from page 6)

making it effective. This is accomlished by construction of curbs. A curb will prevent promiscuous use of this central strip but it should not be too high and should have a reasonable amount of slope so that it will not present an additional hazard.

CURB DESIGN

The design of the curb adopted for this purpose is 6 inches in height above the surface of the pavement with a batter of 4 inches in this 6 inch height. The installation of the curb will depend upon the width of the division strip. Where this strip is of sufficient width to permit safe operation of the vehicle, the curb can be omitted. Our studies at present indicate that with division strips of 20 feet or more in width curbs will not be necessary.

FINANCIAL PROBLEM

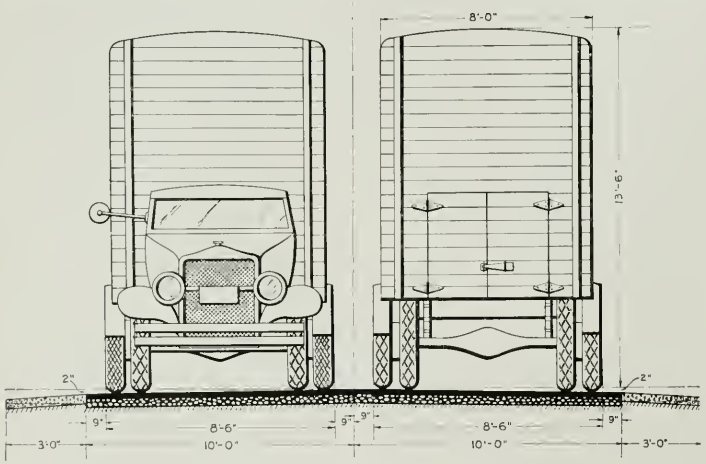
It must be recognized that adoption of higher standards of construction—the expansion of lane width, the divided type of roadway, the increased width of right of way necessary for this type of construction and the improvement of our intersections—will further complicate our already acute financial problem.

Not many of our citizens realize that California has within her borders some 2,328,000 registered motor vehicles comprising 8.3 per cent of the nation's total, while the motor vehicle and gas tax revenues available to the Division of Highways for maintenance and construction represent but 3.7 per cent of the revenues collected by the various states. The movement of vehicles on our highways is increasing rapidly and approximates now some 18,000,000,000 vehicle miles per year. This may possibly account for the fact that at each budgetary period there are presented, by interested parties, meritorious construction projects totalling some twenty times the revenues available for construction.

MUST BUILD SAFER ROADS

This is a serious problem but our mounting highway accident toll is more serious. The time has come to face this issue squarely. We must build the safest highways possible even though it be a definite curtailment in the total mileage constructed.

Granted that our divided type of highway and the wider traffic lane alone will not solve the accident problem, we still must contribute our share toward its solution. Such a policy will be economically sound from the savings on the obsolescence factor alone and will be a desirable and notable contribution to safety and planning for the future.



This sketch shows two trucks passing on 10-foot highway lanes. The clearance between them is only 1 foot, 6 inches. Each vehicle is only nine inches from the curb and the danger of sideswiping is apparent. Eleven-foot lanes will greatly minimize this danger.

Registration Increases

An increase of 7.40 per cent in the registration of automobiles in California during the first seven months of this year as compared with same period a year ago, was shown by Howard Deems, Registrar of Motor Vehicles, in his report to Governor Frank F. Merriam.

In the 1936 period 2,046,857 automobiles had received plates, Deems said, as compared with 2,198,287 this year, an increase of 151,430. Commercial vehicles with pneumatic tires increased by 15,635, motorcycles increased 1,396 and pneumatic tire trailers, 18,811. Solid tire commercial vehicles showed a decrease of 617, and solid tire trailers a drop of 597, bringing a total of fee paid registrations to 2,476,478 as against 2,290,420 of last year.

Soils Course to Be Offered By Bureau of Public Roads

A course in the surveying, sampling and testing of soils, together with the practical application of the results of the tests on soils to actual highway design, construction and maintenance problems, is offered in Washington, D.C., to highway engineers from October 4 to 16, by research engineers of the Bureau of Public Roads of the U. S. Department of Agriculture.

Instruction will be furnished by members of the staff of the bureau thoroughly familiar with the subjects they discuss. Opportunity will be afforded those attending to perform the tests and to keep complete sets of data. Wherever possible, the practical application of the test will be discussed at the time the test is demonstrated. An informal interchange of ideas will further the subject of soil science in the highway field. Highway engineers interested in taking the course should make prompt application for enrollment, giving data as to position and previous experience in soil work.

Angeles Crest Highway Opens Vast Playground

(Continued from page 8)

taken contracts, 1.4 miles, 5.0 miles, and 3.3 miles in length, respectively, and the Division of Highways constructed 2.9 miles with prison labor.

The total amount of money expended to date in bringing the graded highway from Red Box to its present terminus at Chilao is $1,100,000 for 12.6 miles, or approximately $87,000 per mile.

OIL TREATMENT NEXT

Money has been set aside by the Division of Highways sufficient to apply a penetration oil treatment to the graded roadway. It is planned to complete such oiling this fall in order to preserve the excellent surfacing material now in place and to prevent it being washed away by the winter storms. Also the new roadway will then be available to haul supplies to the Division of Highway's camp and provide an easier access to the new construction to be opened up as rapidly as funds become available.

As soon as oiling is completed—sometime next month—the highway as far as Chilao will be open to the public for the first time. No attempt will be made, however, to maintain the roadway for the use of the general public during the winter storm periods.



Angeles Crest Highway cut through decomposed granite cliffs during construction.

ROAD IS FIRE CONTROL

The new highway construction ends at the Newcomb Ranch located just beyond Chilao camp grounds. It is of interest to note that the Newcomb Ranch, 160 acres in extent, was homesteaded in 1878 by Mr. Lewis Newcomb, one of the real pioneers of Angeles Forest area, and is the only parcel of privately-owned land in this area.

Mr. Newcomb's knowledge of the back country and the trails and passes, many of which were first located and constructed by him, was recognized in 1898 when he was appointed one of the first forest rangers by the then newly organized National Timberland Reserve.

The new highway also serves as an important unit for fire control measures. Following the San Gabriel fire of 1924, which burned 50,000 acres of valuable watershed, it was recognized that a more vital system of fire protection was necessary. Inasmuch as early trails had served their day as the transporting medium of men and supplies to fires in back country, plans were formulated and money made available for the construction of a road from Mt. Wilson to the Mojave desert, bisecting the forest.

HELPS ANGELES CREST PROJECT

This first road has proven of tremendous value in the furtherance of construction and progress on the new Angeles Crest Highway, which will "carry on" in a greater way this essential service.

From the Newcomb Ranch property the Angeles Crest Highway is to be further extended to Cloudburst Summit at the elevation of 7040 feet, this section to be constructed by the Division of Highways with prison labor. The camp is now being moved to a new location within the limits of construction. Clearing operations have been under way for about one month and it is expected to have this camp in complete operation by the end of next month.



Appreciation From Reader

101 W. 13th Street,
National City, California,

John W. Howe, Editor,
California Highways and Public Works Journal,
Sacramento, California.

Dear Sir:

My issue of "California Highways and Public Works" just arrived, and in my humble way I wish to compliment you on your most excellent publication, as to complete general make-up and Table of Contents.

It seems to me that each issue is better than the last and then I don't really see how that is possible.

Your high quality paper, type and ink certainly combine to make an easy to be read paper and the cuts are par excellence. Then last, but in no way the least, is the careful editing of the reading material which is mighty near perfect English, which, by the way, would make an ideal approach for the foreign born population to read interesting facts and in so doing acquire a splendid vocabulary of modern words.

* * * * *

When I first came to California, I was deeply impressed with the excellent manner in which the roads were posted with various caution signs and it gives me great pleasure to see the daily progress that our Earl Lee Kelly is applying in keeping our California roads up to date with best improved methods.

* * * * *

Thanks again for your great efforts and trust that I am not selfish in saying: "Keep the good work going on."

Very truly,

J. W. MacCAUSLAND.

SOULÉ STEEL COMPANY

Iron and Steel Products
6200 Wilmington Avenue
Los Angeles

Editor, California Highways
and Public Works,
Box 1499,
Sacramento, California.

Dear Sir:

I congratulate you and the Department most heartily for the sterling worth of your magazine, California Highways and Public Works.

It gets better and better all the time and is one of the publications our office looks forward to receiving each month.

Very truly yours,

N. E. DAWSON.

Valuable Information

GENERAL PETROLEUM CORPORATION OF CALIFORNIA

Los Angeles, Cal.

Mr. John W. Howe,
c/o California Highways and Public Works,
P. O. Box 1499,
Sacramento, California.

Dear Sir:

Since the first of the year I have been receiving the monthly magazine of "California Highways and Public Works" and wish to take this opportunity to extend to you my thanks and appreciation for the courtesy which you or some one in your organization has shown to me in sending this magazine.

I think it is a splendid magazine and find that it contains a great deal of valuable information, particularly for my line of work.

Yours very truly,

FELIX CHAPPELLET

Praise From Havana

MIGUEL VILLA

Ingeniero Consultor
Profesor Titular de Estructuras
Escuela de Ingenieros y Arquitectos
Universidad de la Habana

California State Department of
Public Works,
Sacramento, Calif.

Gentlemen:

I have received the copy of "California Highways and Public Works" containing the history of the San Francisco-Oakland Bay Bridge, which is extremely interesting and amply covers all of the points that I intend to bring out in a forthcoming lecture that I am preparing at the present time.

Thanking you very much for your prompt attention and courtesy in the matter, I remain,

Yours very truly,

MIGUEL VILLA,
Manzana de Gómez 334, Habana, Cuba.

Ontario, California,
August 27, 1937.

Division of Highways,
P. O. Box 1499,
Sacramento, California.

Gentlemen:

Do you ever send your magazine "California Highways and Public Works" to the eastern states?

Friends and relatives write me asking all sorts of questions about the State. So many about the San Francisco Bridge. I can not answer them. But have sent some of your magazines. They were delighted with them and loaned them to friends and relatives.

The magazine is always interesting and such beautiful pictures. It is the best advertising for California I know of. I enclose some addresses of people who would be glad to get the magazine.

Thank you.

(Signed) F. V. WOODBURY.

THE ALL-YEAR CLUB OF SOUTHERN CALIFORNIA, LTD.

Mr. John W. Howe, Editor,
California Highways and Public Works,
P. O. Box 1499,
Sacramento, California.

Dear Mr. Howe:

As a favor to the All-Year Club of Southern California, would you put our new Tourist Information Bureau, 505 West Sixth Street, Los Angeles, on your mailing list to receive California Highways and Public Works?

Our business office already is receiving such a copy but we like to keep that in our files and your magazine is the best way we know to keep the Welcomettes on duty at the Information Bureau informed of highway conditions in California.

Thank you for your trouble.

Sincerely,

(Signed) MINARD FASSETT,
Director of Publicity.

The woman who drives from the back seat is no worse than the man who cooks from the dining-room.

A boy was about to purchase a seat for a movie in the afternoon. The box-office man asked, "Why aren't you in school?"

"Oh, it's all right, sir," said the youngster earnestly, "I've got measles."

Highway Bids and Awards for August, 1937

IMPERIAL COUNTY—Between Trifolium Canal and 7 miles north of Kane Springs, 14.3 miles seal coat to be applied. District XI, Route 26, Sections B, C. A. S. Vinnell Co., Alhambra, $8,180; G. W. Ellis, North Hollywood, $9,435. Contract awarded to R. E. Hazard and Sons, San Diego, $5,990.

IMPERIAL COUNTY—Between Holtville and Brawley, about 9.4 miles, to be graded and surfaced with plant-mixed surfacing. District XI, Route 187, Section Holt., B, C. V. R. Dennis Construction Co., San Diego, $103,004; R. E. Hazard and Son, San Diego, $88,314; Griffith Co., Los Angeles, $110,108; Oswald Bros., Los Angeles, $92,537. Contract awarded to G. W. Ellis, North Hollywood, $87,460.20.

KERN COUNTY—Through Mojave, about 0.7 mile in length to be graded and surfaced with plant-mixed surfacing. District IX, Route 23, Section A. Griffith Co., Los Angeles, $26,873; Oswald Bros., Los Angeles, $27,297; Southwest Paving Company, Roscoe, $28,491; A. S. Vinnell Co., Alhambra, $27,245; Piazza and Huntley, San Jose, $32,416; J. E. Haddock, Ltd., Pasadena, $33,428; Frank Embleton, Albany, $36,718. Contract awarded to S. A. Cummings, San Diego, $25,372.

KERN COUNTY—Between 2 miles south of Greenfield and Mountain View School, 8.0 miles to be surfaced with plant-mixed surfacing and borders to be constructed. District VI, Routes 140 and 143, Sections C. A. Griffith and Co., Los Angeles, $41,-250; Independent Construction Co., Oakland, $44,700; Union Paving Co., San Francisco, $45,630; L. A. Brisco, Arroyo Grande, $53,-482. Contract awarded to Piazza and Huntley, San Jose, $40,790.

KERN COUNTY—A reinforced concrete slab bridge across Poso Creek, about 12 miles north of Bakersfield, consisting of two 36 foot 6 inch spans and two 24-foot 6 inch spans on concrete pile bents and about 0.2 mile of roadway approaches to be graded. District VI, Route 142, Sections A, B. John Jurkovich, Fresno, $21,137; N. M. Ball Sons, Berkeley, $22,206; Rexroth and Rexroth, Bakersfield, $23,695. Contract awarded to Valley Construction Co., San Jose, $20,994.50.

LASSEN and SIERRA COUNTIES—Between Doyle and Nevada State line, about 18 miles, seal coat to be applied. District II, Route 29, Sections E, A. Fredericksen and Westbrook, Lower Lake, $24,795; Lee J. Immel, Berkeley, $25,938; J. P. Brennan, Redding, $26,213; Harms Bros., Litchfield, $26,952; A. Teichert and Son, Inc., Sacramento, $27,065; A. Soda and Son, Oakland, $28,069; George French, Jr., Stockton, $28,810; J. A. Casson, Hayward, $34,075. Contract awarded to Hayward Building Material Co., Hayward, $23,690.

LOS ANGELES COUNTY—Between West Covina and Pomona, 6.6 miles, existing roadbed to be widened, shoulders on portions. District VII, Route 26, Sections W. Cov. & C. W. E. Hall Co., Alhambra, $107,942; Heuser and Garnett, Glendale, $86,616; Daley Corp., San Diego, $110,536; Macco Construction Co., Clearwater, $86,368; A. S. Vinnell Co., Alhambra, $103,923; Geo. J. Bock Co., Los Angeles, $79,324; Griffith Co., Los Angeles, $89,423; Minnis and Moody Const., Los Angeles, $83,795; J. E. Haddock, Ltd., Pasadena, $90,450; Geo. K. Thompson & Co., La Canada, $102,264; Oswald Bros., Los Angeles, $79,569. Contract awarded to Claude Fisher Co., Ltd., Los Angeles, $67,-420.90.

LOS ANGELES COUNTY—Rosemead Boulevard, from Las Tunas Drive northerly 0.07 mile to be graded and paved with plant-mix surfacing, asphalt concrete and Portland cement concrete, and curbs, gutters, and sidewalks to be constructed. District VII, Route 168, Section C. Geo. R. Curtis Paving Co., Los Angeles, $13,258; Dimmitt and Taylor, Los Angeles, $13,853; J. E. Haddock, Ltd., Pasadena, $15,166; Griffith Co., Los Angeles, $14,650. Contract awarded to George O. Gartz, Los Angeles, $12,824.25.

MENDOCINO COUNTY—Between southerly boundary and Point Arena, about 1.2 miles, to be graded and a penetration oil treatment applied. District I, Route 56, Section A. Claude C. Wood, Stockton, $55,-224; N. M. Ball Sons, Berkeley, $38,951; Poulos and McEwen, Smith River, $48,216; Guerin Bros., San Francisco, $47,986; J. V. Galbraith and Don A. Canevari, Santa Rosa, $49,494; Young and Son Company, Ltd., Berkeley, $42,850; George Pollock Co., Sacramento, $41,677; Harold Smith, St. Helena, $48,999; Piombo Bros. & Co., San Francisco, $42,418; A. Soda and Son, Oakland, $51,956. Contract awarded to Chas. L. Harney, San Francisco, $38,579.

MODOC COUNTY—Between 2½ miles west of Cedarville to the State line, 11.8 miles to be surfaced with plant-mix surfacing. District II, Route 28, Section C. Tiesiau Bros., Inc., Berkeley, $11,900; Garcia Construction Co., Irvington, $12,150; McReynolds Trucking Co., Oakland, $13,-000; Fredericksen and Westbrook, Lower Lake, $13,470; Hanrahan Co., San Francisco, $13,800; E. B. Bishop, Orland, $14,-600. Contract awarded to George French, Jr., Stockton, $11,200.

MONO COUNTY—Between Mammoth Lakes and Route 23 near Casa Diablo Hot Springs, 9.0 miles, imported surfacing material to be placed and road-mix surface treatment to be applied. District IX, Route 112, Section A. J. A. Casson, Hayward, $51,450; Basich Bros., Torrance, $55,436; Steward and Nuss, Inc., and Oldfields Trucking Co., Bakersfield, $58,952; A. S. Vinnell Co., Alhambra, $61,618; Peninsula Paving Company, San Francisco, $67,744; Isbell Construction Co., Reno, $79,575. Contract awarded to Oswald Bros., Los Angeles, $44,448.

MONTEREY COUNTY—A steel and concrete bridge across Mud Creek, about 25 miles north of San Simeon. District V, Route 56, Section A. A. Soda and Son, Oakland, $33,321. Contract awarded to E. T. Lesure, Oakland, $31,824.40.

MONTEREY COUNTY—A reinforced concrete girder bridge across Salinas River at Soledad consisting of thirteen 104-foot spans and two 89-foot spans on concrete piers and abutments on pile foundations. District V, Route 2, Section D. J. F. Knapp, Oakland, $336,424; Andy Sordal and R. R. Bishop, Long Beach, $349,116; L. E. Dixon Company, Los Angeles, $387,858; C. W. Caletti and Co., San Rafael, $362,791; Bates and Rogers Construction Co., Oakland, $388,423; John Strona, Pomona, $320,-158; D. W. Thurston, Los Angeles, $349,-633; Lindgren and Swinerton, Inc., San Francisco, $377,723. Contract awarded to Lord and Bishop, Sacramento, $310,468.

ORANGE COUNTY—About 4 miles east of Anaheim, bridge across Santa Ana River to be repaired. District VII, Route 178, Section A. J. S. Metzger and Son, Los Angeles, $13,650; Wm. R. Shriver, Los Angeles, $12,271; R. H. Travers, Los Angeles, $11,298; Sully-Miller Contracting Co., Long Beach, $15,870; C. O. Sparks and Mundo Engineering Co., Los Angeles, $11,-447; Southern California Roads Co., Los Angeles, $12,980; J. E. Haddock, Ltd., Pasadena, $13,280. Contract awarded to Harry L. Foster, San Diego, $10,488.

PLACER COUNTY—Between Auburn and Colfax, about 15.7 miles seal coat to be applied to existing pavement. District III, Route 37, Section A, B. Heafy-Moore and E. F. Hilliard, Sacramento, $11,383; Fredericksen and Westbrook, Lower Lake, $11,319; Garcia Construction Co., Irvington, $10,850; Hayward Building Material Co., Hayward, $11,602; Hemstreet and Bell, Marysville, $10,850; Louis Biasotti and Son, Stockton, $12,425; E. A. Forde, San Ausemo, $11,112. Contract awarded to Granite Construction Co., Watsonville, $10,808.

SAN BERNARDINO and RIVERSIDE COUNTIES—At various locations, about 16.9 miles, road-mix surface treatment to be applied to existing shoulders. District VIII, Routes 190 and 187, Sections C, D-D. Oilfields Trucking Co., Bakersfield, $20,220; George Herz Co., San Bernardino, $18,325; A. S. Vinnell Co., Alhambra, $19,727. Contract awarded to Oswald Bros., Los Angeles, $16,836.50.

SAN DIEGO COUNTY—Reinforced concrete girder bridge across San Onofre Creek, 17 miles north of Oceanside, six 50-foot spans on concrete piers with pile foundations to be widened. District XI, Route 2, Section D. Oscar Oberg, Los Angeles, $55,777; Metropolitan Construction Co., Los Angeles, $67,437; Claude Fisher Co., Ltd., Los Angeles, $49,445; C. O. Sparks and Mundo Engineering Co., Los Angeles, $52,281; R. R. Bishop, Long Beach, $51,615; Griffith Co., Los Angeles, $48,993; D. W. Thurston, Los Angeles, $50,316; J. E. Haddock, Ltd., Pasadena, $48,186; Carlo Bongiovanni, Los Angeles, $55,484. Contract awarded to B. G. Carroll, San Diego, $46,811.

SAN DIEGO COUNTY—Between one mile south of San Onofre and north county line about 2.6 miles to be graded, paved with Portland cement concrete and plant-mixed surfacing on crusher run base to be placed. District XI, Route 2, Section D. Daley Corp., San Diego, $109,319; David H. Ryan, San Diego, $112,693; Metropolitan Construction Co., Los Angeles, $140,358; C. Fisher Co., Ltd., Los Angeles, $112,840; E. Paul Ford, San Diego, $105,598; C. O. Sparks and Mundo Engineering Co., Los Angeles, $180,093; Oswald Bros., Los Angeles, $124,438; Griffith Co., Los Angeles, $121,889; D. W. Thurston, Los Angeles, $112,121; J. E. Haddock, Ltd., Pasadena, $122,395. Contract awarded to B. G. Carroll, San Diego, $104,466.10.

SAN DIEGO and IMPERIAL COUNTIES—Furnish and apply liquid asphalt between Julian and Kane Springs, 30.5 miles. District XI, Route 198, Sections E, F, G, A. Morgan Bros., Maywood, $5,485; Regal Oil Co., Long Beach, $5,007; Paulsen and March, Inc., Los Angeles, $6,015; Gilmore Oil Co., Los Angeles, $5,087. Contract

(Continued on page 25)



Horse-drawn equipment spreading asphaltic oil surface on concrete pavement north of Fresno in 1913. Modern asphalt spreader.

State Highway Commission Observes 25th Anniversary

(Continued from page 11)

It was not, however, until the 1923 session of the legislature that action was taken and approved by the Governor imposing a tax of two cents per gallon of gasoline. This law provided that one cent of the tax be used by the Division of Highways for reconstruction and maintenance of State highways and one cent be distributed among the counties for improvement to county roads.

REORGANIZATION

In 1921 the State Department of Public Works was created with the Division of Highways as a subdivision. With the advent of Governor Friend W. Richardson into office in 1923 the Highway Commission was taken out of the Department of Public Works and established as a separate State Department. Under this new Commission the mileage on the State system was redistributed and three districts added to the original seven into which the State was divided in 1911.

During the period from 1923 to 1927, while revenues from the gas tax and vehicle registrations increased rapidly and reconstruction and maintenance activities advanced, it became evident that provision must be made for financing new construction on roads which had been made State highways but for which provision had not been made under the bond acts. This very apparent need was met by the 1927 session of the State legislature by the passage of an act providing for an additional one cent tax on gasoline, the proceeds to be used exclusively for new construction projects.

In July, 1927, the Department of Public Works was reorganized and the Division of Highways recreated as a unit in that State Department, and the Division has remained in the Department of Public Works since that time.

In 1933 the legislation establishing the gasoline tax was amended to provide that an amount equal to ½-cent of the State's share of the revenue from the three cent tax should be apportioned to cities for improvement to State highway routes and city streets. This work was placed under the supervision of the Division of Highways, and in 1935 a new act provided for the allocation of an additional ½-cent to cities for use on city streets other than State highway routes and the 1933 act amended to limit the original ½-cent to State routes within cities.

Other legislation in 1933 lifted the restriction stipulating that the State's share of the 1923 gas tax could not be used for new construction and provided that all funds accruing to the State for highway purposes be placed in a single fund and allocations to construction, reconstruction and maintenance be left in the hands of the California Highway Commission in biennial budgets with the limitations that an amount equal to not more than the revenue from one cent tax per gallon of gasoline be budgeted for maintenance and that administration charges should not exceed two per cent of the revenue.

At the inception of the State highway system in 1909 the legislature provided for 3,082 miles of road. Extensions added by the second and third bond acts increased the total mileage to 5,560. Subsequent legislative additions, particularly that of 1933, have added highways to the system to the extent that there are now approximately 13,900 miles of State highways of which nearly 12,700 miles are rural roads.

The following tabulation gives the yearly mileage since 1918:

MILEAGE OF STATE HIGHWAY SYSTEM

Year	Total Mileage Improved Roads	Total System Mileage	Year	Total Mileage Improved Roads	Total System Mileage
1918	1,808	4,421	1930	4,784	6,581
1920	2,495	6,168	1931	5,574	7,332
1922	3,840	6,400	1932	5,735	7,347
1924	3,866	6,400	1933	9,782	14,006
1926	4,160	6,589	1934	9,939	14,019
1928	4,332	6,565	1935*	9,783	13,958
			1936*	10,152	13,870

* The decrease in mileage in 1935 and 1936 is due to completion of construction and rerouting of highways.

TOTAL MILEAGE OF STATE HIGHWAYS IN CALIFORNIA BY TYPES—JANUARY 1, 1936.

Type	Total Mileage
Paved	6,690
Low-cost bituminous surface	3,506
Oiled, graded or unimproved	3,674
Total	13,870

STEADY PROGRESS

During this twenty-five years, as the mileage and funds required for construction and maintenance purposes have been rapidly increasing, engineering standards and construction practice have made remarkable advances.

Alignment and grade standards of 1912 have long since become obsolete, short radius curves and rolling grade lines have given way to long sweeping curvature with constant grade. Improvements in grading machinery have made possible excavation of cuts and construction of embankments to depths and yardage which only two decades ago would have been considered highly impractical.

Width and thickness of pavements have undergone changes. Heavy trucking equipment requires heavy pavements and high speed traffic demands wide pavements, so the old sixteen-foot pavements, four inches thick, have been increased to eleven-inch pavements laid in widths from twenty to forty feet providing for multiple lanes of traffic, and now the trend is to divided highways separating traffic moving in opposite directions.

BRIDGE CONSTRUCTION

Bridge construction has undergone a similar transition, while basic designs have remained more or less the same, deck widths and strength required for increased loadings have had to be adjusted to meet the requirements of present day traffic. Construction of both rail and highway grade separations have increased to a volume nearly equal to that of bridge construction in order to provide safer facilities for travel.

The State highway organization of necessity has grown with the expansion of the system. The original seven districts have been increased to eleven and the four hundred employees of the first Highway Commission in 1912 have been replaced by the nearly 6000 individuals now in the employ of the Division of Highways. It is of interest to note that of those origiual 400 the names of 54 are still on the highway roll for 1937.

VITAL FEDERAL AID

In this great growth of the State highway system, one of the vital factors has been the federal aid which has been given to California during the past twenty years.

On March 16, 1917, the Governor signed an act of the California State legislature accepting the provisions of the Federal Aid Road Act of 1916. This federal act established a Federal Aid Highway System on the State systems of each State and made available federal funds for improvement to these designated highways.

In California this federal system originally included some 4,900 miles, which, when 90% had been improved, was increased to 5,600 miles. In addition thereto, California has 558 miles situated in national forests and other federal reservations giving a total of 6,158 miles of federal roads on the State system.

LARGE INVESTMENT IN ROADS

Since 1917 regular federal aid funds have been allotted to California amounting to approximately $61,000,000. In addition to these funds federal allocations have been made in the amount of $52,143,000 from the various relief appropriations of Congress for work on the State highway system and feeder roads.

Beginning with the $18,000,000 bond issue of 1909, the people of California, and the Federal Government have provided for the construction and maintenance of State highways through the various sources of revenue which have been described with the result that California has become one of the leaders, not only in the United States but in the world, in the development of high standards of highway design, construction and improvement. The total income of the Division of Highways from 1912 to June 30, 1937, has amounted to $497,030,000, from which expenditures on the State highway system have been made in the sum of $492,746,000.

This capital investment by California is one of the State's greatest assets and has been an important means in much of the development of both the economic and cultural life of her citizens during the past twenty-five years.

"Did you read about that movie actor's mystery marriage?"

"No, I'm too darn busy puzzling about my own."

Members of California Highway Commission From August 2, 1911, to September 1, 1937

Name	Residence	Date of Appointment	Termination of Membership
Burton A. Towne	Lodi	Aug. 2, 1911	Resigned Jan. 14, 1914
Charles D. Blaney*	Saratoga	Aug. 2, 1911	Resigned Mar. 1, 1917
N. D. Darlington	Los Angeles	Aug. 2, 1911	Resigned Jan. 8, 1923
Charles F. Stern	Eureka	Jan. 15, 1914	Resigned Dec. 21, 1918
Henry J. Widenmann*	Vallejo	Mar. 1, 1917	Died Oct. 6, 1918
Charles A. Whitmore	Visalia	Nov. 29, 1918	Resigned Jan. 8, 1923
Emmett Phillips*	Sacramento	Dec. 21, 1918	Died June 18, 1919
George C. Mansfield*	Oroville	June 24, 1919	Resigned Jan. 9, 1923
Harvey M. Toy	San Francisco	Jan. 9, 1923	Resigned Jan. 3, 1927
Louis Everding	Arcata	Jan. 9, 1923	Resigned Jan. 17, 1927
Nelson T. Edwards	Orange	Jan. 10, 1923	Resigned Jan. 3, 1927
Ralph W. Bull	Eureka	Jan. 6, 1927	Resigned Jan. 6, 1931
J. P. Baumgartner	Santa Ana	Jan. 6, 1927	Resigned Jan. 6, 1931
M. B. Harris	Fresno	April 18, 1927	Resigned Jan. 6, 1931
Joseph M. Schenck	Los Angeles	Aug. 19, 1927	Resigned Jan. 6, 1931
Fred S. Moody*	San Francisco	Aug. 19, 1927	Resigned Jan. 6, 1931
Earl Lee Kelly	Redding	Jan. 6, 1931	Resigned Oct. 18, 1932
Frank A. Tetley	Riverside	Jan. 6, 1931	Resigned July 31, 1935
Timothy A. Reardon	San Francisco	Jan. 6, 1931	Resigned May 5, 1936
Harry A. Hopkins	Taft	Jan. 6, 1931	
Philip A. Stanton	Anaheim	Jan. 6, 1931	
Dr. W. W. Barham	Yreka	Dec. 20, 1932	Resigned May 21, 1935
Ray Ingels	Ukiah	May 21, 1935	Resigned Oct. 4, 1935
C. D. Hamilton*	Banning	Aug. 1, 1935	Died April 24, 1936
H. Ray Judah	Santa Cruz	May 6, 1936	
Paul A. Jasper	Fortuna	May 6, 1936	

* Deceased

Federal Accident Studies Planned

Various leaders in Congress are considering the idea of expanding facilities of the United States Census Bureau to collect more adequate statistics on motor accidents. Cooperation of the States would be enlisted.

The report states there is growing recognition of need for more complete facts on the number of motor vehicle deaths and injuries and data on the circumstances of accidents.

This is said to have been emphasized by the wide variance in recent estimates of the number of motor fatalities in the United States last year.

Motor vehicles in the United States last year used 535,000,000 gallons of lubricants, according to a preliminary estimate received by the Automobile Club of Southern California.

"When the judge ruled Smith had to pay alimony how did he feel about it?"

"Chagrined."

"And how did his wife feel about it?"

"She grinned."

IMPROVED SCREED ADJUSTMENTS FOR CEMENT CONCRETE FINISHING MACHINES

By H. J. DOGGART, Resident Engineer, District V

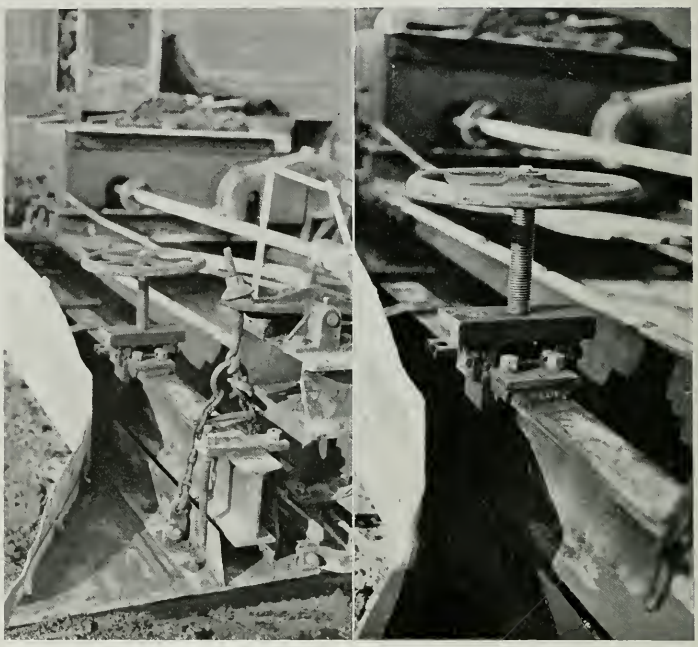
CONTRACT 85TC2, road V-Mon-2-H&I, from Bradley to six miles south of San Ardo, in Monterey County, was one of the few projects during 1936 in which Portland cement concrete pavement was specified to be laid in twenty-foot widths.

Since this project traversed a rolling, foothill territory along the Salinas River, horizontal curvature was frequent, and continual warping of pavement crown into superelevation was necessary. In order not to distort the superelevation by carrying the crowned section through the curves, it was necessary to adjust the screeds of the finishing machine as the equipment proceeded in and out of the superelevation.

The adjustment with which the available type of machine is equipped is not speedy enough for this purpose without seriously delaying the progress of the work. At the beginning of paving operations before finisher screed adjustments were made, it was necessary to shut down the mixer for a period of several hours while a pavement curve was being constructed.

The Peninsula Paving Company, Contractor, requested the Construction Department of the Division of Highways to assist in solving this difficulty. Through conference with the writer, the Contractor's General Manager, Miss A. L. Beard, and Master Mechanic O. M. Johnson, the following design was decided upon, and built under Mr. Johnson's direction:

The regular screed plate was not sufficiently rigid without the multiple points of adjustment to strengthen it, in order to insure its remaining in adjustment. To overcome this defect, two 3½-inch by 2½-inch by ⅜-inch angle irons were welded to the upper side of the screed plate longitudinally for the full length of the plate, and were cut at the two adjusting points in the center of the 21.5-foot overall length of screed. They were spaced at the proper interval to serve as guides for the 6¼-inch by 3¼-inch I-beam screed member, and prevent warping of the screed plate.



The picture on the left is a general view of the reconstructed screed; that on the right is a close-up view of screed adjusting device.

It was considered necessary to have an adjustment out near the end of the screed and a quarter point adjustment in the middle of each ten-foot section.

The screed was first so constructed, but under operating conditions, it was found that the screed plate was now sufficiently rigid, and the quarter point adjustment was unnecessary. The active adjustment consisted of a vertical 1¼-inch round bolt with 7 threads per inch, and a 12-inch wheel mounted on the top to speed up the adjustment.

The extreme end pairs of the original adjusting bolts were left in place to serve as tilting controls for the screed end shoe. The set of adjustments in the mid-point of the screed were drawn up tight and remained in the same position for any setting of the screed plate. This in effect, hinged the screed plate in the center, and permitted the plate to be crowned by turning the adjusting wheel at each end of the plate. The two-wheel adjustments replace the original 48 adjusting nuts with which each screed was originally equipped.

This method of adjustment was so successful that the finishing machine operator was able to make the proper adjustments at 20-inch intervals throughout the transition and operate the machine without any loss of time to the mixing unit or delay to the finishing operations following the machine.

Highway Bids and Awards for August, 1937

(Continued from page 21)

awarded to Square Oil Co., Inc., Los Angeles, $4,995.

SAN LUIS OBISPO and SANTA BARBARA COUNTIES—Between San Luis Obispo and Toro Creek, between Las Cruces and Lompoc, and between Lompoc and Santa Ynez, about 18.5 miles to be surfaced with plant-mixed surfacing and seal coat. District V, Routes 56 and 149, Sections D, AB, B, D. Granite Construction Co., Ltd., Watsonville, $28,796; R. E. Hazard and Sons, San Diego, $33,415. Contract awarded to L. A. Brisco, Arroyo Grande, $26,521.26.

SHASTA COUNTY—At Salt Creek about 13 miles east of Redding, remove existing timber truss and furnish and install steel plate girder. District II, Route 28, Section A. M. B. McGowan, Inc., San Francisco, $4,999; J. P. Brennan, Redding, $5,465. Contract awarded to M. A. Jenkins, Sacramento, $4,192.20.

SISKIYOU COUNTY—A reinforced concrete slab bridge across Scott River about one mile southwest of Fort Jones, consisting of four 30-foot 6-inch spans and two 23-foot spans on concrete pile bents, and approximately 0.4 mile of roadway to be graded and road-mix surfacing to be applied. District II, Route 82, Section C. Chas. Kuppinger, Lakeport, $33,698; J. P. Brennan, Redding, $35,080; W. K. Van Bokkelen, Alameda, $37,877. Contract awarded to A. Soda and Son, Oakland, $30,562.

SOLANO COUNTY—Between Carquinez Bridge and 0.9 mile north about 0.8 mile to be graded and paved with Portland cement concrete and plant-mixed surfacing. District X, Route 7, Section F. A. Teichert and Son., Inc., Sacramento, $77,184; Fredericksen and Westbrook, Lower Lake, $74,978; Bodenhamer Construction Co., Oakland, $75,948; A. G. Raisch, San Francisco, $77,187; Macco Construction Company, Clearwater, $81,517; Chas. L. Harney, San Francisco, $81,304; Louis Biasotti and Son, Stockton, $83,777; Frederickson and Watson Construction Co., Frederickson Bros., Oakland, $86,313. Contract awarded to Union Paving Co., San Francisco, $70,737.70.

TEHAMA COUNTY—Between south boundary and Corning, about 8.9 miles, seal coat to be applied. District II, Route 7, Section A. Granite Construction Co., Watsonville, $5,518; E. A. Forde, San Anselmo, $5,564; Hayward Building Material Co., Hayward, $5,755; Lee J. Immel, Berkeley, $5,777; Tieslau Bros., Inc., Berkeley, $5,882; E. F. Hilliard, Sacramento, $6,153; N. M. Ball Sons, Berkeley, $6,627; Hemstreet and Bell, Marysville, $6,836. Contract awarded to Garcia Construction Co., Irvington, $5,358.75.

TRINITY COUNTY—Between Helena and Big Bar, about 8.5 miles in length to be surfaced with road-mix surfacing. District II, Route 20, Section E. Garcia Construction Co., Irvington, $90,080; McReynolds Trucking Co., Oakland, $9,646; Tieslau Bros., Inc., Berkeley, $9,841; Pacific Truck Service, Inc., San Jose, $10,011; George French, Jr., Stockton, $11,240; Helwig Construction Co., Sebastopol, $11,540; Lee J. Immel, Berkeley, $13,325. Contract awarded to E. E. Smith, Eureka, $8,595.

Julius: "I hear that Nero is torturing the Christians again."

Marcus: "Yeah, someone ought to take that fiddle away from him."

Galt Highway Change Will Eliminate Hazards

By R. E. PIERCE, District Engineer

AN IMPORTANT improvement in U. S. 99, in the vicinity of Galt, Sacramento County, which has been under consideration for many years, should be under construction early this fall.

Starting just north of the Southern Pacific Railroad, Ione Branch, north of Galt, the new line will run in a straight line southeasterly to Dry Creek, the county boundary between Sacramento and San Joaquin counties; thence continuing on the same course until it connects with the present highway at Jahant Corner on Cherokee Lane. The length of the new line is 4.98 miles, making a saving in distance of 0.57 mile over the present route.

WILL ELIMINATE NINE CURVES

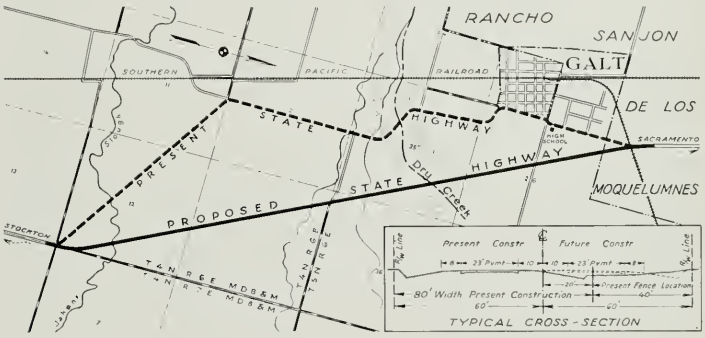
The new line will eliminate nine curves, ranging in radius from 368 feet to 3000 feet, having a total angle of over 371 degrees, or more than one complete circle; while the new line will have only two curves, one at each end of the change, with radii of 3000 feet and 5000 feet, and a total angle of less than 37 degrees.

Another important feature will be a new bridge over Dry Creek of adequate width. The present bridge is narrow and has been a bottle-neck for years.

This project has been planned for an ultimate two-way divided roadway, both as to right of way and location of the two lanes. This will be accomplished by acquiring a right of way 120 feet in width and placing the two lanes, now to be constructed, on an offset, so that a 20-foot separation will be provided on the ultimate divided roadway.

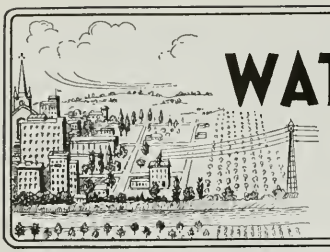
DISTANCE SHORTENED

This is the first project in this district on which additional lane width over the old standard 10-foot lane will be constructed. The new pavement will consist of two 11-foot lanes.



The method of handling the right of way is slightly different. A width of 120 feet is being acquired. It is planned to place the fences so that the two lanes now being constructed will center on an 80-foot strip on the west side of the right of way, the other 40 feet being available for use by the adjacent property owner until such time as the highway is developed to its ultimate section.

This new line by shortening distance, by-passing the narrow business street in Galt, and with much improved alignment, should materially increase the capacity and safety on this road on which more than 4000 cars travel daily.



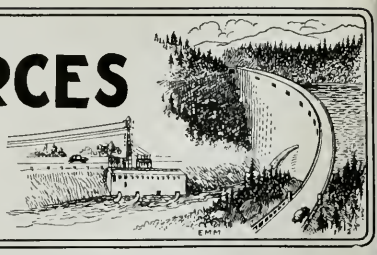
DIVISION OF WATER RESOURCES

OFFICIAL REPORT

FOR THE MONTH OF

August, 1937

EDWARD HYATT, State Engineer



The Interior Department Appropriation Bill providing $12,500,000 for construction of the Central Valley Project has been approved by the President. This appropriation will make approximately $22,500,000 available for construction during the current fiscal year as about $10,000,000 remains in unexpended funds previously appropriated.

The President has also signed the Rivers and Harbors Bill which carries an amendment officially authorizing the Central Valley Project as a Federal undertaking, and removes all legal obstacles to its consummation. With the approval of the Interior Department Bill carrying the appropriation for the project and its authorization as a Federal project in the Rivers and Harbors Bill, work will be carried out without delay.

IRRIGATION DISTRICTS

Refinancing of outstanding bonded indebtedness through loans from the Reconstruction Finance Corporation has made steady progress. By provisions of an act passed at the last Legislative session the districts are enabled to proceed with their programs by filing petitions in the Superior Courts when plans have been accepted by two-thirds of the bond holders and approved by the California Districts Securities Commission. Under this act plans of Palo Verde, El Dorado, James, Merced, Lindsay-Strathmore and Anderson-Cottonwood districts have recently been approved.

FLOOD CONTROL AND RECLAMATION

Maintenance of Sacramento Flood Control Project.

Investigation is being made as to the structure and material composing a section about 300 feet long in the south levee of the Sacramento By-pass, which shows a tendency to slide and settle when wet. It is expected that this section may have to be rebuilt with suitable material.

Relief Labor Work.

W.P.A. Project No. 6654 in Yolo County, on which men were engaged in cleaning levees and clearing brush in the Sacramento By-pass, was discontinued on August 24, 1937. It is expected that men will be available to resume this work on about October 15th.

Bank Protection Program.

The maintenance program recommended by the Chief of Engineers, included in the report of the Board of Engineers for Rivers and Harbors dated June 14, 1937, and contained in Senate Committee Document 75th Congress, "Sacramento River Flood Control Project, California," included in the Rivers and Harbors Act, HR 7051, 75th Congress, 1st Session, has been approved by the President.

This act provides for the amendment of the present project act to increase the Federal allocation to the Sacramento flood control project by $2,500,000 to be expended as the Federal participation in the maintenance of the flood control project during a five-year period, and to include a complete program for bank protection on the main Sacramento River. The State of California will contribute one-third of the total cost of bank protection and levee set-backs.

A program for bank protection has been tentatively selected to include works which will cost in all approximately $150,000, of which the State will pay $50,000. This work will include the extension of several of the units constructed during the last year, and new units to be done include those which are considered to be most urgently needed. Actual construction by the War Department is now under way on several of these units.

SACRAMENTO FLOOD CONTROL PROJECT

The Reclamation Board has requested this office to undertake the construction of an irrigation canal in the vicinity of the Colusa By-pass and the filling of the borrow pit on the Burr Mitchell property at the levee along the right bank of the Sacramento River north of Colusa. Both of these works are in connection with the acquisition of rights-of-way and flowage easements, both at an estimated cost of $37,000. Preliminary surveys have been made during this period of these projects.

SUPERVISION OF DAMS

Application was filed on August 12, 1937, by the Whiting Company, El Toro, California, for approval of the plans and specifications for the construction of Whiting Dam. This dam is to be a rolled earth fill structure 41 feet in height and storing 600 acre-feet and is estimated to cost $30,000. It is to be located on a tributary to San Diego Creek in Orange County.

Application for approval of plans for the repair and alteration of the Pilarcitos Dam was filed on July 30 1937, by the City and County of San Francisco. This application was approved on August 10, 1937.

Application was filed on August 13, 1937, by the Tuolumne Gold Dredging Corporation, La Grange, California, for the alteration of the Cardoza Dam. This application was approved on August 23, 1937.

Application was filed on August 19, 1937, by the Nevada Irrigation District, Grass Valley, for the approval of plans for the repair and alteration of the French Lake Dam.

The work at present under way at the Mad River Dam of the city of Eureka consists of pouring concrete on the left abutment sections, preparations for the pouring on the arch sections and the excavation of the stream bed upstream from the arch for the placing of impervious fill.

WATER RIGHTS

Supervision of Appropriations of Water.

Thirty-seven applications to appropriate water were received during July. Fourteen were denied and fifteen were approved. In the same period, nine permits were revoked and rights were confirmed by the issuance of licenses in twelve other cases.

That mining continues to predominate as an important activity among new appropriators is evidenced by the large applications which are filed for mining purposes and permits issued. Among the applications received during July was one for an appropriation of 150 second-feet in Humboldt and Trinity counties at a cost of $150,000. Another for an appropriation in Trinity County at a cost of $60,000 and numerous other applications for large amounts. The largest single appropriation allowed during the month was for mining purposes.

SACRAMENTO-SAN JOAQUIN WATER SUPERVISION

Activities during the past month have been in the field gathering data from which to make of record the amount of water diverted from the streams in the Sacramento and San Joaquin valleys. This report will also show the amount of land irrigated, the return flow therefrom and also the flow in the valley streams. The sampling of water in the delta for salinity is being carried on at a number of stations sufficient to record the rate of advance of the salinity.

TRAFFIC CONGESTION ON ROUTE 4 IS RELIEVED





Completed by the Griffith Company of Los Angeles in July at a cost of $241,000, the additions to the old two-lane pavement for eleven and seven-tenths miles south from Grove Street in Bakersfield on Route 4 has now relieved the traffic congestion which was developing on this main artery from the San Joaquin Valley to Los Angeles. The work was financed jointly by the State and the city of Bakersfield which contributed $27,000 for the work inside the city limits.

Four paved lanes with shoulders oiled out to the curb lines are now provided inside the city; three lanes extend ten and one-half miles south from the city limits. Funds provided in the present budget will finance a contract to be let this year which will connect this improvement with the three-lane pavement from Los Angeles at Grapevine to give a minimum of three lanes for the full distance of 112 miles from Los Angeles to Bakersfield.

As shown in the upper picture, four traffic lanes are now provided from the center of Bakersfield to the south city limits.

The lower picture was taken south of Bakersfield and shows the wide traffic lanes which add to the safety in passing on this heavy freight route from the San Joaquin Valley to Los Angeles.

Cost of Drilling Cut Down By New Equipment

(Continued from page 2)

duty 110-volt, 1000-watt generator, providing lights for night operating is also built into the motor assembly.

The main hoisting unit is a 7-ton, double drum type with a three speed transmission. Both of the drums are supplied with ¾-inch steel cables, for sampling and drilling lines. A small single drum utility hoist, with nigger head attachment is mounted near the derrick for operating a sand line.

The derrick was constructed from heavy steel ship channels and designed for a thirty ton pull. A Keystone Spudding sheave assembly is welded to the top of the derrick for the spudding cable and the sand line. Two additional sheaves accommodate a heavy pulling line for sampler operations. The overall height of the derrick is 32 feet from the ground when erected, and eleven feet six inches when folded and ready for the road.

ASSEMBLY

Power from the motor and transmission assembly is carried through an extension shaft to the main drive sprocket. Through the medium of a 4-inch chain, power is then transmitted to a main countershaft mounted parallel with the engine. This shaft serves the dual purpose of driving a secondary longitudinal countershaft through mitre gears and a secondary transverse countershaft which operates the spudding pinion and utility hoist. The longitudinal shaft drives the double drum hoist and the rotary table. Double and triple tooth sprockets and chains are used throughout for transmitting the power. All shafts are mounted in self-aligning roller bearings.

The entire unit complete with drilling tools is transported on the four-wheel drive truck. This truck, equipped with tractor tread type tires and dual rear wheels, has proved its worth on steep hillside climbs and pulling over soft unstable ground.

A 2-inch, two-stage centrifugal pump mounted on a separate skid frame and powered with a 4 cylinder, 12 h.p. air cooled gasoline engine is used in conjunction with the drill outfit for dewatering holes and jetting casing when required. A 2-inch Ventura tube type hydro-jet is used in conjunction with the pump for dewatering holes and making tests of ground water flow. The latter assembly can be used to dewater a 7-inch hole to a depth of about 120 feet if the inflow does not exceed 20 gallons per minute.

SAVING IN DRILLING COSTS

Since the rig was constructed in February, 1937, it has worked very satisfactorily and proved invaluable for investigating a variety of foundation conditions. Approximately 70 holes, twenty-four inches in diameter, have been bored to depths varying between 30 and 80 feet and averaging 45 feet at costs of $0.25 to $0.75 per foot in clay and shaly clay, and between $0.50 and $1.00 per foot in soft shales and cemented sand formations.

These drilling costs are exclusive of overhead but include all labor charges and a drill rental of $2.50 per hour. Sinking of shafts in similar ground, under old methods, to depths of 20 or 30 feet often cost more than $5 to $10 per foot making such exploration too expensive for extensive use. The cost of procuring cores with the new type Porter Soil Sampler has also been reduced through the development of this special drill outfit.

General requirements for the drill and equipment were drawn by the writer. Mr. F. E. Burnside, Shop Superintendent of the Equipment Department, and Mr. C. M. Sanborn, Foundation Drilling Foreman of the Materials and Research Department, supervised the mechanical design and construction of the outfit.

Since the drill was completed, it has not been returned to the shop for alterations or repairs, and this very satisfactory operation reflects the sufficiency of the design and the excellence of the work done by the Equipment Department.

Automobile drivers who limit their top speed to 50 miles per hour are 72 per cent safer than the average motorist, according to a recent survey by an eastern insurance organization.

Judge—What were you doing when that joint was raided?

Locksmith—Making a bolt for the door, yer honor.

Eugene, Oregon,
August 28, 1937.

California Highway
Department.

Dear Sirs:

Last Tuesday, Aug. 24, on my way north 27 miles south of Cave City, I broke an axle of my car to which a trailer was attached. The accident happened on an incline and in a dangerous position on account of curves.

It was but a short time before your maintenance department auto came along and towed me up the mountain so that I would be off the highway, for which I was grateful. The service I received did not end there. Mr. Horace C. Nutting, your maintenance foreman, took the time and patience to find out what the trouble was so that I could advise a mechanic at Crescent City or Grant's Pass. The trouble could not be defined until Mr. Nutting took the time to locate it.

In all my travels I never met as courteous a gentleman and I want to commend him to you. I will greatly appreciate it if you will advise him of this letter, if it is not against the rules of your department.

I would like also to commend the State of California on its wonderful highways. As a visitor that has traveled practically every mile of your State, I can not but praise your splendid highways.

I have been traveling on a sightseeing vacation for three years all over the United States and I feel that I am a judge of your highways.

I am respectfully,

(Signed) WM. T. PARSONS,
508 Schwehm Building,
Atlantic City, N. J.

STATE OF CALIFORNIA

Department of Public Works

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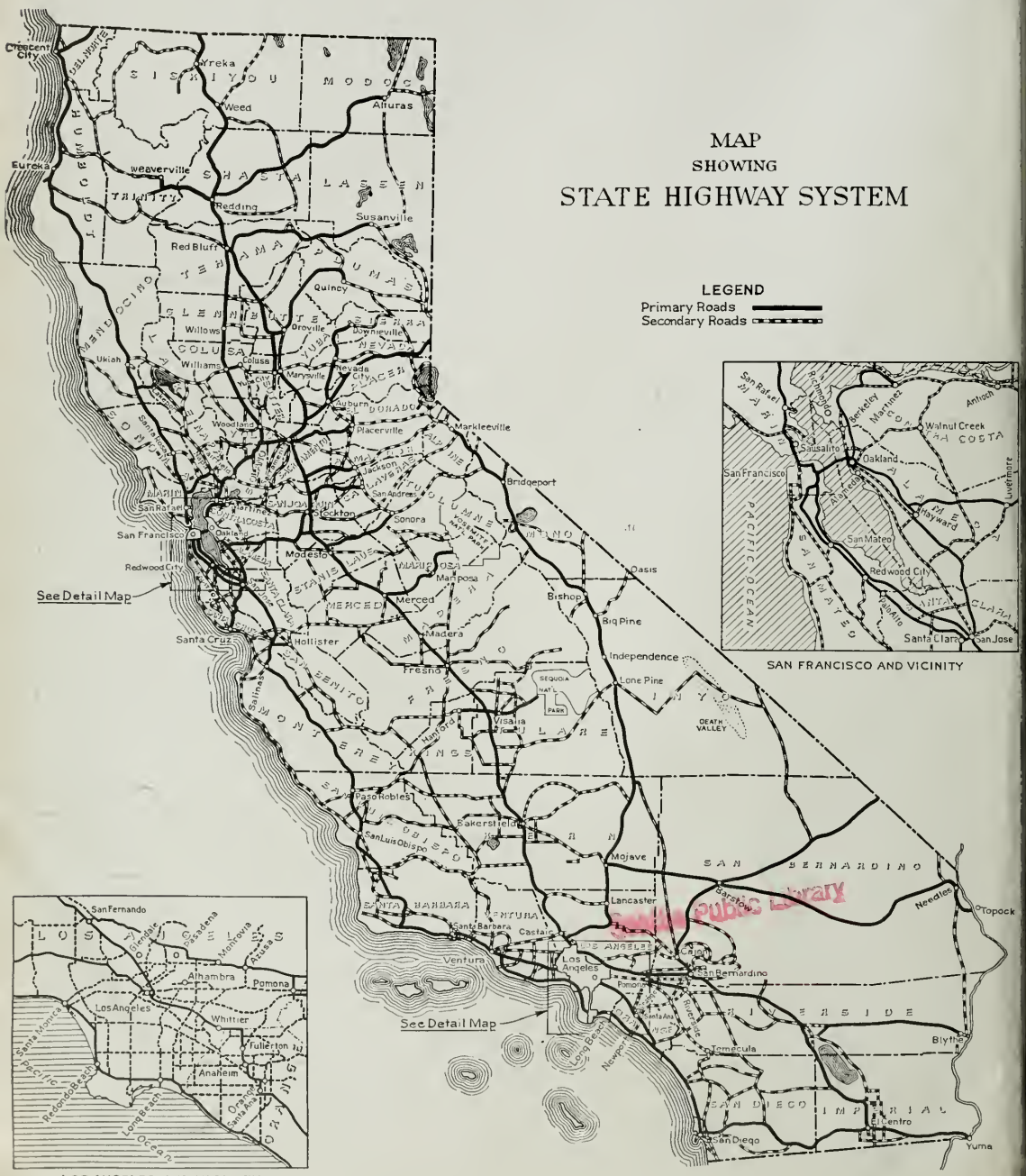
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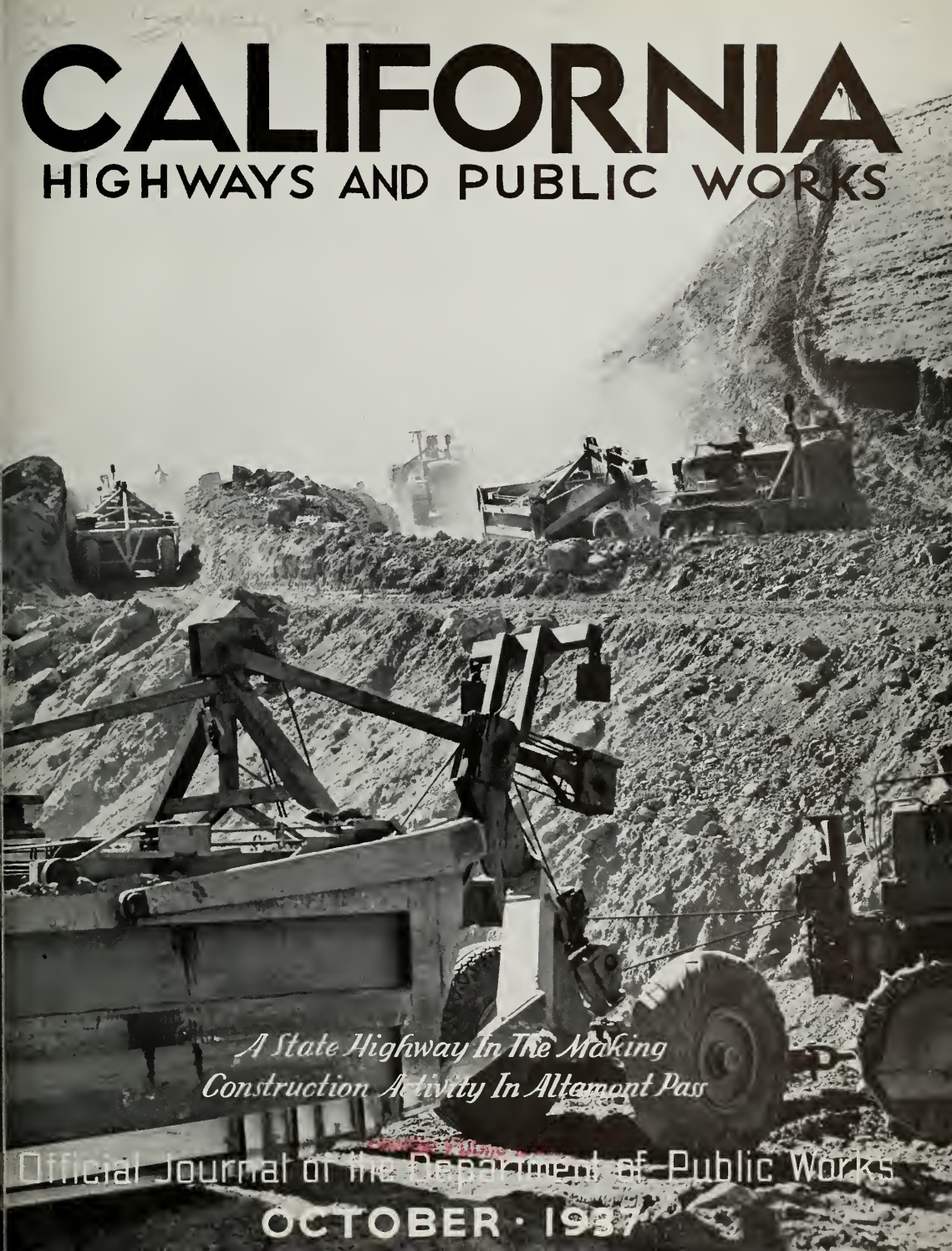
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HIGHWAYS AND PUBLIC WORKS



A State Highway In The Making
Construction Activity In Altamont Pass

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Official Journal of the Department of Public Works

OCTOBER · 1937

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways of the Department of Public Works, State of California

EARL LEE KELLY, Director | C. H. PURCELL, State Highway Engineer | JOHN W. HOWE, Editor

Published for information of the members of the department and the citizens of California

Editors of newspapers and others are privileged to use matter contained herein. Cuts will be gladly loaned upon request.

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Historic U. S. 40 Highway Over Sierra Nevada Made More Attractive By State

Donner Route Is Beautified

By C. H. WHITMORE, District Engineer

BOTH tourists and commercial drivers will be benefited by the improvement of three sections of U. S. 40 in California between Sacramento and Truckee. Construction on these projects will be completed late in October or early November, enabling this portion of U. S. Route 40 to more satisfactorily serve the heavy traffic between Sacramento and points east.

Since this road is a part of an important transcontinental route, both tourist and commercial traffic has always been heavy during the summer months. During the past few years this highway has been traversable during the winter months with the result that the winter traffic has steadily increased.

ROCKLIN-LOOMIS UNIT

The first project, located between Rocklin and Loomis, is essentially a replacement of some three miles of worn-out pavement.

Located in the valley at the base of the foothills of the Sierra Nevada mountains, the alignment through the greater portion of the project is tangent. On the northerly two miles, new construction adjacent to the old road was so arranged as to permit the use of the old road during paving operations. An excellent grade line has been obtained throughout the project, several short pieces of adverse grade having been eliminated and sight distances greatly improved.

The old pavement consisted of 15 feet of Portland cement concrete 4 inches in thickness, to which road-mixed borders 2½ feet wide had been added. This pavement, which was built in 1917 to serve traffic very much lighter than that using the road at present, was rapidly failing, with the result that maintenance costs were becoming excessive. The new pavement selected for this section was Portland cement concrete 20 feet wide by 0.55 to 0.75 of a foot in thickness. Crushed gravel or stone borders 2½ feet wide are being placed on both sides. The contract for this construction, the cost of which will be approximately $135,000, is with Basich Brothers, and the Resident Engineer for the State is J. D. Greene.

HISTORIC ROUTE

The second project, between Soda Springs and Donner Summit, is about 3.7 miles in length and passes through mountain scenery which is surpassed by few sections of the State. In addition to being a section of scenic beauty, the route is fraught with historical interest.

The Sierra Nevada mountains were, of course, the final major barrier crossed by "49'ers" on their way to the California gold diggings. Crossing the mountains in the summer was bad enough, with passes 7,000 feet or more in elevation, but in the winter months it was practically impossible, as was so tragically exemplified by the historic Donner party.

We of the modern age, traveling in our automobiles on hard surfaced roads which extend into every nook and cranny of the country, can hardly appreciate the transportation problems which confronted those early pioneers in their struggles to penetrate the natural barriers between them and the new frontiers which they had determined to conquer.

Developed from the wagon road, which was soon pushed through the mountains and improved from time to time to serve changing types of traffic, the road across the Donner



Newly paved section of U. S. 40 looking toward Donner Summit and bordering Donner Lake



Beautiful stretch of realigned U. S. 40 Highway along shoreline of Donner Lake which will give motorists a finer view of this historic body of water.

Summit has gradually changed from a hazardous route replete with dangerous curves and steep grades to a modern mountain highway.

The portion being reconstructed at present was graded in 1924 and surfaced with road-mixed crushed rock in 1927, the width being approximately 18 feet. Considerable difficulty was experienced with the drainage of the roadbed which was especially troublesome during the winter and early spring months. To alleviate this condition an extensive underdrain system, consisting of over 14,000 feet of perforated metal pipe in rockfilled trenches, was constructed during 1936.

To replace the old surfacing, which was becoming inadequate for the existing traffic, a Portland cement concrete pavement 20 feet wide by 0.55 to 0.75 of a foot thick, supplemented by a 3-foot crushed rock border on each side, was chosen. Minor revisions in grade and alignment were made where required to conform to accepted standards.

PARKING AREA PROVIDED

Approximately one-half a mile from the easterly end of this project is the Donner Summit Bridge, from which may be obtained one of the most beautiful views in all the Sierra Nevada mountains. Standing on the bridge and looking toward the east, one sees Donner Lake, a sapphire blue body of water in an evergreen setting, 1,000 feet below. Each year thousands of people stop to enjoy and photograph this scene.

In order to eliminate the hazard to traffic caused by parking cars along the narrow road adjacent to the bridge and to provide a point from which tourists can conveniently view the beauty of the surrounding country, the construction of a sight point and parking area has been included in this project.

The parking area, which is about 75 feet by 150 feet, is being graded and paved with a bituminous surfacing. This area will be protected by rubble masonry piers joined by heavy chains, the piers being set upon a rubble masonry retaining wall. Fredericksen and Westbrook are the contractors on this $240,000 project, and W. G. Remington is Resident Engineer for the State.

DONNER LAKE PROJECT

The third project under construction is located along the shore of Donner Lake, between the foot of Donner Grade and the east end of the Lake. The existing road at this location was graded by the county and subsequently road-mixed with fuel oil by State forces. The road followed along the shore of the lake with comparatively low standards of grade and alignment.

The new construction, approximately 2.5 miles in length, consists of bituminous plant-mixed surfacing 20 feet wide by 0.25 of a foot thick on a crusher run base course 0.5 of a foot thick. The shoulders on each side are to be given a bituminous road-mix surface treatment. Changes

in the alignment and grade were made to obtain the accepted standards for mountain construction. In order that the natural beauty of this portion of the road might be preserved for the benefit of those traveling over it, the right of way through the major portion of this project includes the lake front. The Pacific States Construction Company is the contractor on this project, with J. W. Corvin the Resident Engineer for the State. The cost of the project will be approximately $132,000.

Completion of these three major projects on U. S. 40, at a total cost of about half a million dollars, will enhance both the utility and the beauty of the road, thus increasing both the tangible and the intangible values of this popular and heavily traveled route.



Above is view of section of new Donner Summit Highway. Below is picture of Donner Summit Bridge and new lookout station for tourists.



CHEATING DEATH

By LESTER H. GIBSON
District Engineer

FOR many years past the larger manufacturing and utility companies have made a practice of having men in their organizations instructed in First Aid.



Men of Salinas Maintenance Crew in District V illustrate first aid treatment for highway accident victim.

The larger oil companies of California are notable examples and periodically have instructions given to their men and hold contests to promote proficiency in the handling of accident cases.

During the summer of 1936 engineers in District V of the Division of Highways took cognizance of the value of first aid knowledge and decided to promote instruction among the men of the district, believing that nowhere could knowledge of First Aid be of greater value as affecting the men themselves and the public traveling the State highways of the district.

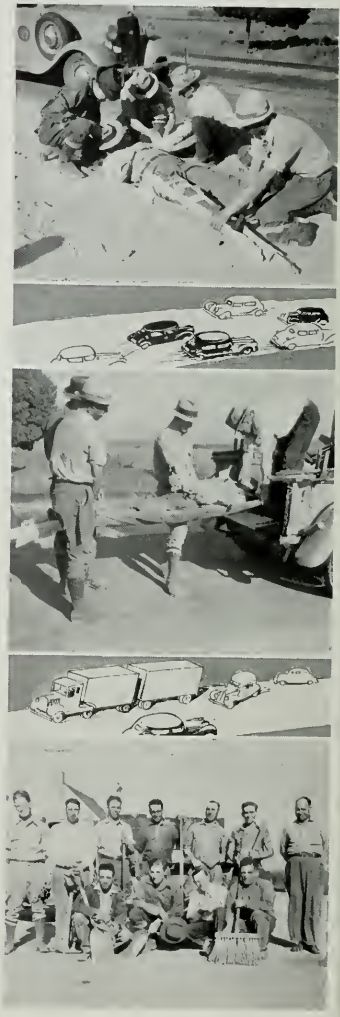
MAINTENANCE MEN SCHOOLED

Particular attention was directed to the Maintenance Department because the men who maintain our highways are performing the most hazardous service and, being scattered in their occupation along the highways, are in a position to give assistance to victims of automobile accidents.

In further promoting the idea, correspondence was carried on between the District Office and the Maintenance Superintendents for the furtherence of obtaining First Aid instruction for the employees. It was emphasized at all times that the taking of lessons in First Aid was to be entirely voluntary on the part of the employees, but it was pointed out that the knowledge to be obtained was believed to be of great value to the individuals themselves and that by cooperating they would also be performing a great service to the public. Knowledge of First Aid on the part of an employee is consequently believed to cause a man to be of greater value to his organization.

RED CROSS AIDS

All local chapters of the American National Red Cross welcome the entrance of any groups of individuals into realms of first aid. It was found that the local chapters were already organized to give assistance and instruction and upon their aid being sought by District V a most hearty cooperation was given.



Crude but efficient first aid. Maintenance men do the best they can with the tools they have. Group picture of first aid crew.

ON THE HIGHWAY

Doctors affiliated with the Red Cross were appointed to supervise the various student groups of State highway employees. Eight such groups were formed, scattered throughout the four counties comprising District V, which include the counties of San Benito, Monterey, San Luis Obispo and Santa Barbara.

It may be of interest here to show briefly what knowledge is obtained by taking the Red Cross lessons.

FIRST AID COURSE

Course of instruction for the standard course includes ten lessons of one and one-half hours each. Instructions are given by experienced physicians residing within the limits of each Red Cross Chapter. Red Cross Manuals which are very complete on all classes of First Aid are the basis of instruction. These are studied by the men throughout the course.

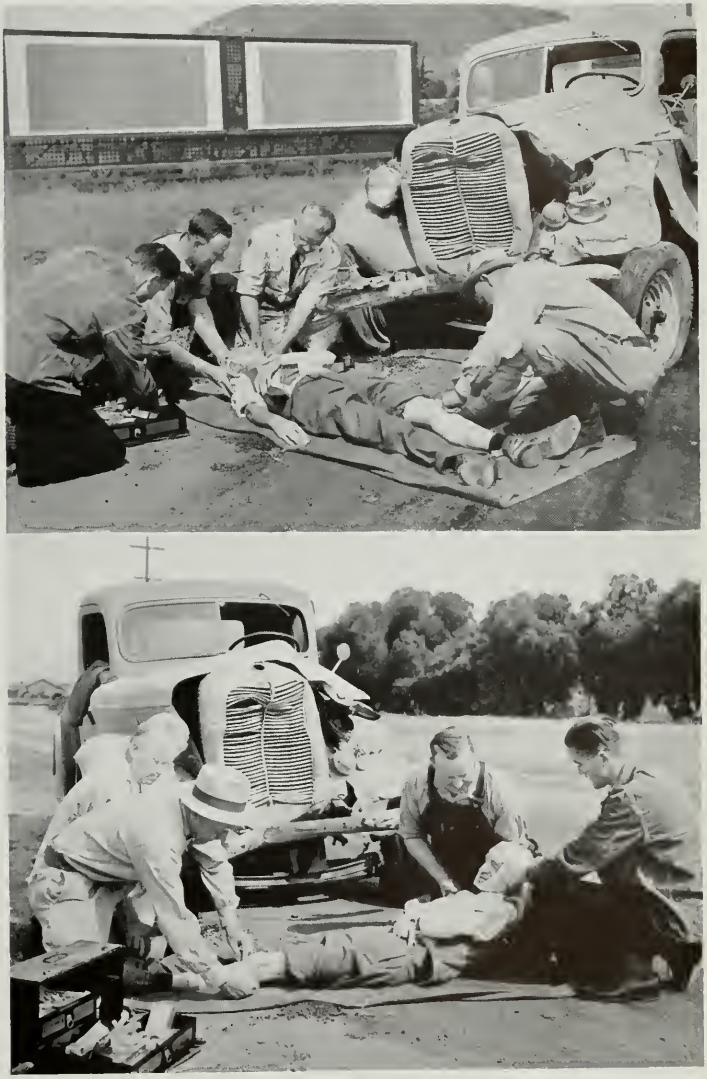
The first half of each lesson is devoted to instruction talks by the doctor on the various classes of First Aid as shown in the manual. During the latter half of the lesson practical knowledge of handling accident cases is obtained by instructing the men how to use bandages, handle splints, stop the flow of blood and meet various other situations that might arise. The students themselves practice this work before the instructor until they become proficient. Between lessons they are required to study various portions of the manual. It should be stated the instruction includes the character of accidents that may occur around the home, so the knowledge obtained is of great value to the individual regardless of his occupation.

CERTIFICATES AWARDED

At the end of the course of instruction the student is required to pass an examination before he is given the pocket card which certifies that he has completed the Standard Course of Instruction in First Aid prescribed by the American National Red Cross. This card is given only for a period of three years, after which period it is necessary for him to take another course of lessons in order to be able to continue to carry a certificate. The

(Continued on page 14)

second card issued, however, certifies that the individual has completed the Advance Course of Instructions. The advance course includes a review of



Members of the Maintenance Crew stationed at San Luis Obispo go into action in posed picture showing emergency treatment they are prepared to give to highway accident victims in District V.



Recently completed steel and concrete bridge over Santa Margarita River with railroad bridge in background.

PROGRESS ON TRAIL OF PADRES

By E. E. WALLACE, District Engineer

EARLY next Spring, when the five contracts on the Coast Route north of Oceanside are completed, California will have a beautiful unbroken stretch of three and four lane pavement extending from San Diego to Santa Barbara, a distance of 220 miles, paralleling the shores of the Pacific.

The El Camino Real is probably the oldest highway in California with the development extending over a century into the past and originating with the trails of the Padres. Then followed the wagon trails and the first semblance of roads detouring far back into the canyons and gulches.

Today there is still evidence of some of the old roads crossing the streams far back in the hills and following the course of least resistance, suitable probably for the occasional traffic they were supposed to serve. The first paved highways then developed to accommodate the few slow-speed automobiles, and again bridges were too expensive and detours into the ravines and around the hills were resorted to.

Finally, after many years of progressive development, a modern highway accommodating thousands of high speed cars per day, will soon be the proud possession of California.

On the highway north of San Diego where opportunity and finances permitted, divided highways have been provided totaling 7.0 miles. Across the Torrey Pines Mesa, through Cardiff and north of Oceanside, the old pavement on rolling grades has been utilized for traffic in one direction, trees have been saved and developed into a center dividing strip, and the new pavement has been placed outside of the center dividing strip on proper grade and alignment, thus accomplishing the divided roadway with very little additional expense.

On the new projects north of Oceanside the development has been so planned that with future widening the black center will become the dividing strip and the safe divided highway will be accomplished at the minimum of expense.

Through the Santa Margarita Ranch the present route meanders along the base of the hills and over

(Continued on page 8)



Upper—New grade separation over Santa Fe tracks near San Onofre, nearing completion. Center—Bad curve through underpass north of Oceanside which will be eliminated by new highway shown on left which is under construction. Lower—Looking south from new Santa Margarita River Bridge showing new forty-foot asphalt concrete pavement.

Progress on Trail of Padres

(Continued from page 6)

the humps with a crooked, rolling highway on which vision is greatly obstructed. Many serious accidents have occurred there due to the combination of poor visibility, poor alignment, narrow highways, volume of traffic and poor drivers. Here the highway has been relocated following closely the alignment of the Santa Fe Railroad and between the railroad and the ocean. Many deep gouges have been crossed with no sacrifice of alignment or grade.

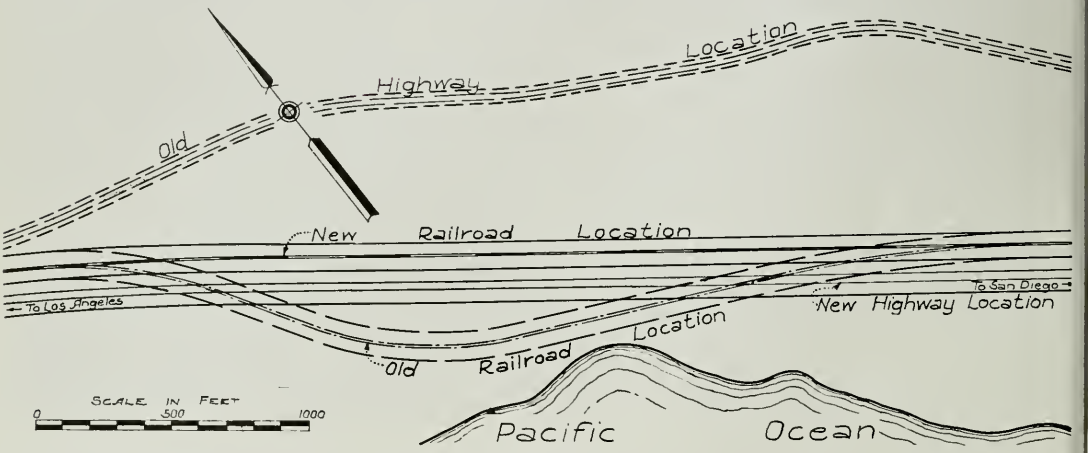
NEW BRIDGE BUILT

A new bridge has been constructed across the Santa Margarita River in making two line changes in the railroad with consequent advantage in the parallel new highway alignment.

RAILROAD COOPERATES

One of these changes replaces a short loop and reverse curve with a straight cut-off; the other, although less important, increases the radius and reduces the angles.

During the working out of the new road location it was found that if the highway was placed along the tracks as they then existed the railroad would be permanently hampered in the use of high speed trains. The entirely safe and adequate for all traffic, and an attraction to all California visitors.



where several structures were completely washed out in the past. Several bridges have been widened and straightened and a new grade separation is being constructed near San Onofre.

Levees are being constructed to confine the San Mateo River to the channel and the channels are being cleared of growth to prevent further damage such as occurred last winter when traffic was stopped temporarily.

All of the work is being handled with practically no delay or inconvenience to the heavy volume of traffic.

It has been found possible to surpass even the old railroad alignment by the cooperation which he have had with the Santa Fe Railway Company ultimate railroad schedule between Los Angeles and San Diego proposes a much faster schedule and such speeds would be impracticable with the existing sharp curves.

The Santa Fe paid all of the expense of realigning their tracks and cooperated with the State and with the Rancho Santa Margarita to the mutual benefit of both transportation means, and the line changes are now in use by the railroad.

Considerable landscaping of the roadsides and erosion control have been accomplished as appropriations have become available, and funds have been set aside for landscaping portions of the new projects.

It is hoped to make this Coast Route an attractive, scenic boulevard,

Bay Bridge Work Progresses

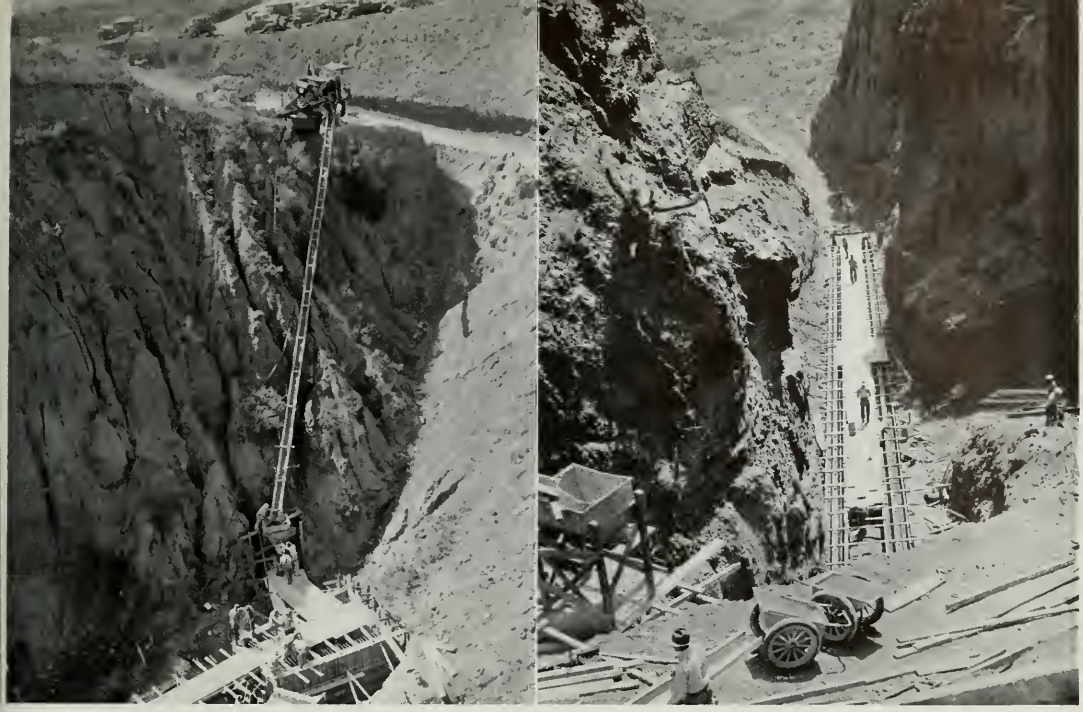
First concrete for the Port of Oakland Highway Overhead Approach to the San Francisco-Oakland Bay Bridge was poured on October 5th.

The approach, curving over the main bridge approach just east of the Toll Plaza, will provide a vitally necessary direct connection between the Port of Oakland and the Bay Bridge without any traffic intersection, Chief Engineer C. H. Purcell announced.

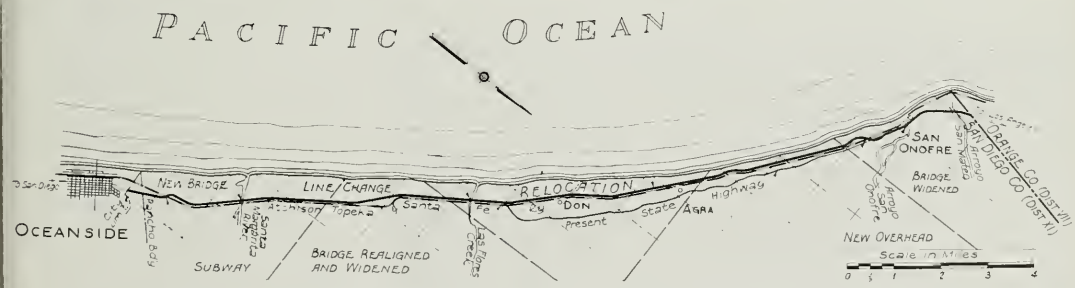
The Port Overhead, costing approximately $450,000 will also clear all bridge trains. Work to date comprises erection of the two-lane "On" and "Off" ramps to the approach.

All concrete piers have been completed for the Interurban Electric (S. P.) Overhead at the storage yards opposite the Toll Plaza, and erection of steel for the superstructure is scheduled for this week, Mr. Purcell said.

Work on the piling for the trestle approach to the Interurban Electric "Y" Overhead at 26th Street is three-fourths completed on the west side. This overhead will clear all mainline Southern Pacific trains.



These pictures illustrate magnitude of highway culvert drainage construction on project north of Oceanside.



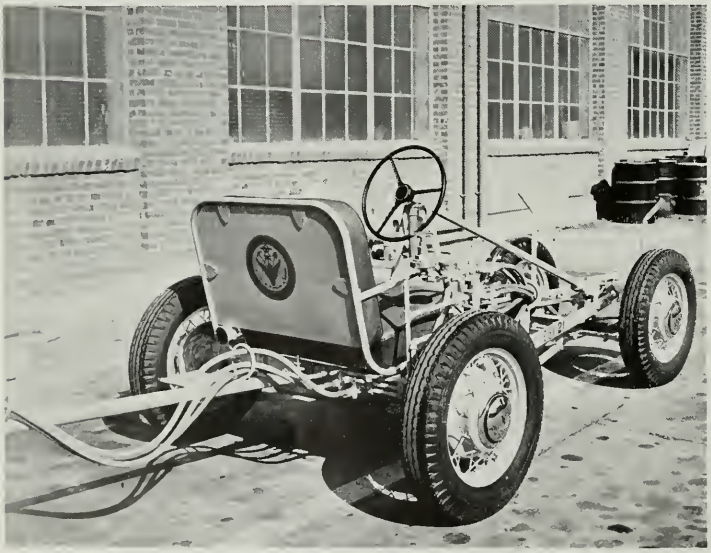
This sketch shows line of existing highway south of San Onofre and realigned route being built.



Two views of completed 4-lane divided highway. On left Torrey Pines Mesa section. Right—Stretch through Leucadia.

New Traffic Stripe Marking Machine

By R. H. STALNAKER,
Equipment Engineer

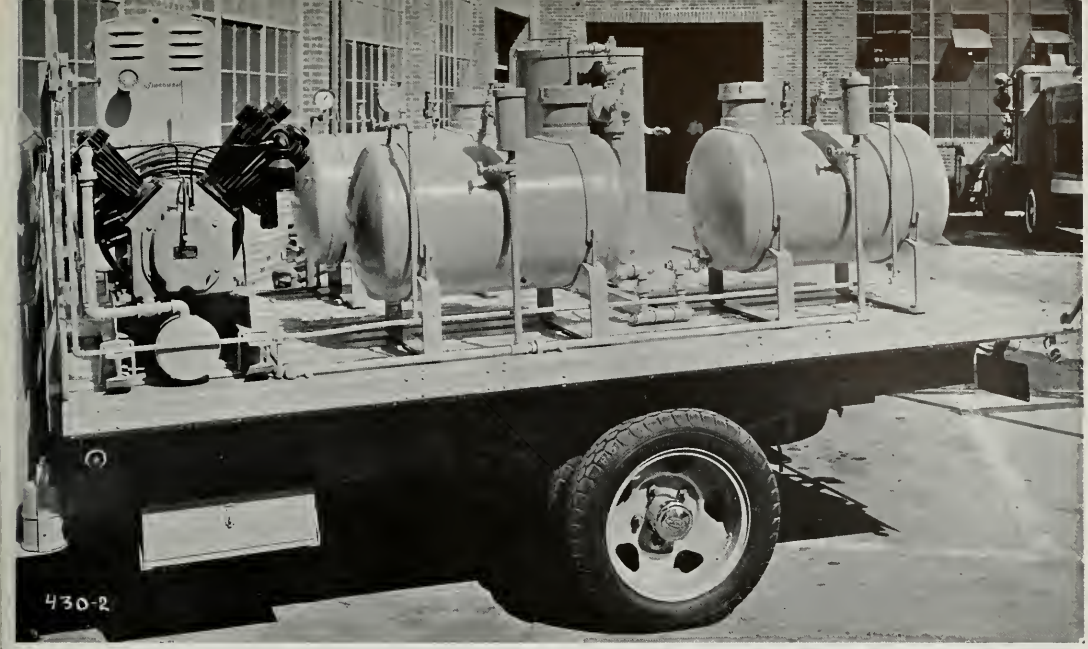


Upper—Front view of traffic stripe marking machine showing guide pointer and hose connection to truck. Lower—Rear view of stripe marker.

THE rapid expansion of the traffic stripe marking program of the Division of Highways has required the development of larger and more efficient machines for putting down these stripes.

The first machines owned by the Division of Highways were hand-propelled, and would only put down a few miles of single line per day. The latest machines, developed and built by the department, will put down 20 to 25 miles of stripe per day and will lay either a 4-inch white stripe or two 3-inch white stripes separated by a 3-inch black stripe at one operation.

As will be seen from the accompanying illustrations the striping machine proper is pushed ahead of a truck on which is mounted the compressor and engine for supplying compressed air, and the tanks which supply the paint. An agitator for mixing the white traffic lacquer is also mounted on the truck. This



truck is a 1½-ton, 157-inch wheel base chassis equipped with a standard 7 feet by 12 feet stake-side body.

The compressor used is a 2-stage air-cooled compressor delivering approximately 32 feet of free air per minute at 600 r.p.m. The compressor is driven by a 4-cylinder air-cooled gasoline engine. This combination gives ample air for the operation of three guns in putting down the triple stripe.

The marking machine proper is mounted on Chevrolet wheels and fitted with a Chevrolet steering gear. The pointer shown in one of the accompanying illustrations is kept over the guide line and determines the position of the stripe. When the unit is being towed behind the truck this pointer assembly folds back over the steering column and the front wheels are lifted off the ground by hooking the ring which appears in the illustration into the draw-bar of the towing truck. In this way the unit can be towed at a high rate of speed without weaving or endangering traffic.

The spray guns used are a special type designed specifically for traffic stripe marking. A lever mounted at the left of the operator's seat enables him to raise the whole spray gun assembly from the pavement so as to clear traffic buttons or other obstructions encountered. When the spray guns are raised a pan slides forward under them so as to catch any drip.

The width of the line is regulated by plates set in notches in a frame and can be changed in a few minutes. The change from single to triple stripe can likewise be made quickly.



Upper—Truck body of stripe marker showing compressor and paint tanks, agitator in far center. Lower—Full view of latest type stripe marking equipment in use in District VII.



Abolish Curves On Route 79 In Ventura County

By W. I. TEMPLETON
Resident Engineer

NEARING completion in Ventura County are two sections of road on Route 79. The work is being done under one contract although some 3½ miles separate the two sections.

Starting at Pyle Road one section 1.22 miles in length extends easterly through the Rancho Sespe eliminating two 800-foot radius curves and one 300-foot radius curve, substituting two 2000-foot radius curves. The point of beginning on the other section is at "A" Street, easterly on Ventura Street 0.96 mile in the city of Fillmore to the junction of the existing highway on Route 79.

(Continued on page 18)



Newly surfaced highway between Santa Paula and Sespe Ranch in Ventura County. Lower—Stretch of new highway between Sespe Ranch and Fillmore.

New Signing Policy on U. S. Routes

THE Executive Committee of the American Association of State Highway Officials is carrying out certain policies concerning U. S. numbered routes, previously approved by a very large majority of the State Highway Departments.

Under the new policy, additional routes for U. S. numbering will be greatly limited and stress will be laid upon the availability of the many State numbered routes for interstate traffic. Map makers will be urged to recognize U. S. numbered roads and well established State numbered roads as of equal importance—both to be printed in the same color.

The original system of U. S. numbered roads was established in 1926. Its purpose was to facilitate travel on the main interstate lines over the shortest routes and the best roads. It has passed the preliminary development stage, and has now reached the period of review, revision and consolidation. U. S. numbering system now needs perfecting rather than expansion.

NEWER, BETTER ROUTES OPENED

New construction has opened up newer, better and shorter routes. Demands of interstate traffic have increased and are more exacting. In harmony with the improved condition of State roads, State route markers of the several States have more and more become dependable trade-marks of quality in those routes.

The establishment of a U. S. number as a guide for interstate traffic over certain roads has no connection with the designation of Federal funds for road construction. These numbers may recognize a State road which has been constructed entirely by the use of State funds.

It was never intended that the U. S. numbered system should absorb or supplant the State numbered routes. It is intended by the uniform marking of the U. S. routes in two or more States, to facilitate the movement of interstate traffic. Thus, with a relatively limited mileage, the U. S. numbered road system must meet the changing conditions if it is to endure and serve the purpose for which it was intended.

The new policies which will govern the action of the executive committee of the association are as follows:

1. The executive committee of the American Association of State Highway Officials shall have full authority to review the U. S. numbered road system and the numbering and marking thereof, to make additions, changes, extensions, revisions or reductions in said road system and to revise the numbering or marking thereof.

2. Before approving any addition, change, extension, revision or reduction in the U. S. numbered road system, or the numbering or marking of any U. S. numbered road, the executive committee shall consult the State Highway Department of the State or States through or within which such addition, change, extension, revision or reduction is located.

U. S. MARKERS PROTECTED

3. The State Highway Department, by a favorable vote on the adoption of this program and policy agrees and pledges its good faith that it will not erect U. S. markers on any road or take down or change the U. S. markers on any road without the authorization, consent or approval of the executive committee of the American Association of State Highway Officials.

4. No additional road shall be added to the U. S. numbered road system, and no existing U. S. road shall be extended except where there is a definite showing of an adequately improved highway carrying an established and necessary line of interstate traffic not otherwise provided for by existing U. S. routes and for which traffic adequate service can not be provided by State route numbers.

ROUTES RESTRICTED

5. No new U. S. route located wholly in one State shall be established. U. S. routes, less than three hundred miles in length, heretofore established and located wholly in one State, shall be eliminated either by consolidation with other U. S. routes or by reverting to State routes, as rapidly as the State Highway Department and the executive committee of the American Association of State Highway Officials can reach agreement with reference thereto.

6. The executive committee shall encourage the State highway departments in the development of continuous State route numbers extending into two or more States rather than the establishment of additional U. S. numbered routes, and shall encourage the substitution of continuously numbered State routes for relatively short U. S. routes now located in two or more States.

NO NEW DIVIDED NUMBERS

7. No new divided numbers (such as U. S. 96-W and U. S. 96-E etc.) shall be adopted. Existing divided U. S. numbers shall be eliminated as rapidly as the State Highway Department and the executive committee can reach agreement with reference thereto.

8. Existing U. S. routes shall be consolidated, improved and shortened.

(A) By connecting two or more relatively short routes into one longer route.

(B) By relocating portions of existing routes so as to follow newer, better or shorter roads.

(C) By the establishment of new numbers following in general existing U. S. numbered routes but taking advantage of new roads or short cuts where the changing of present numbers is not practical.

HIGHWAY LEGENDS

9. A suitable highway legend, which may be copyrighted, shall be devised by the executive committee. Such legend will be recommended for use to all travel map makers, also for use by the State Highway Departments. This legend is to show, in a uniform manner, the suitability for travel not only of the U. S. numbered routes but also of State routes.

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Members of First Aid Crew at San Luis Obispo. Left to right: George Sowash, Paul Mayer, Paul Wagner, J. L. Taylor, W. P. Inman and A. A. Kambeitz.

Cheating Death on the Highway

(Continued from page 5)

the previous course and gives additional knowledge of First Aid.

Instruction was started by the first group in September, 1936, and the last group completed its course in April, 1937. Response by the employees of the Division of Highways in this matter was very gratifying. The groups were of good size and nearly all of the men completed the course. It took but a very short time for the men to see the value of the work they were doing and their enthusiasm to gain proficiency constantly increased.

MEN GAVE OF TIME

It should be realized that these men gave considerable of their private time in affording cooperation. Some of these men were compelled to drive as far as sixty miles at night in order to be present for the lessons. In some instances it was necessary for the men to provide their own manuals, practice bandages, etc. No one can question the loyalty of such men to their organization or devotion to the public interest.

SERVICE FOR PUBLIC

At the conclusion of instruction to all groups it was found that eighty-three men had received certificates from the Red Cross. These included men of various classifications, but the great majority were those in the Maintenance Department, ranging from the District Maintenance Engineer to the laborer. Smaller groups included men from the District Shop and engineers from the District Office.

It is felt that all of these men have performed an extraordinary service for the public good. Tribute should also be paid to the Red Cross officials and the doctors who gave so freely of their time.

The total road mileage of the world is 9,268,397, or one mile of road to every 5.3 square miles of the total land area. The United States has a total mileage of 3,065,264, or one mile of road for every square mile. Japan has one mile of road to each 0.2 square mile; United Kingdom, one to 0.5; Germany, one to 0.8. Egypt has but one mile of road to each 92 square miles.

"Bill, the baby just swallowed the matches, what can I do?"

"Use my cigarette lighter."

Contractors Race Against Winter On Road Project

By J. W. VICKREY
District Engineer

WORK is being rushed to completion on an improvement a few miles north of Laytonville between Sapp Creek and Pepperwood School in Mendocino County, which will be of material benefit to persons using the Redwood Highway between Ukiah and Eureka.

This contract involves an estimated expenditure of $177,314 and the principal contract items are: 165,000 cubic yards of roadway excavation, 31,500 tons of imported borrow, and 8,825 tons of mineral aggregate for plant-mixed surfacing.

The contract was approved on June 15, 1937, with a 125-day time limit, making the estimated date of completion November 13, 1937. This very short time limit was set to insure completion of the work prior to winter, as, if construction operations were permitted to carry over into the winter months, considerable inconvenience would be occasioned to traffic using the Redwood Highway.

In approximately three months the contractors, Hemstreet and Bell of Marysville, have completed the roadway excavation and most of the imported borrow base which is being placed for the plant-mixed surfacing. At this rate of progress the work will be completed within the time limit.

The completed improvement which involves a large channel change to carry the flow of Ten-Mile Creek, in addition to the normal items of highway construction, will provide a thirty-foot roadway with a shallow gutter replacing the usual roadside ditch and in the distance of slightly over three miles will save over 2100 degrees of curvatures.

The actual improvement is well indicated by the following table showing the comparison between the present road and the improvement now under way:

	Length miles	No. of curves	Degrees of Curv.	Min. radius
Present	3.51	59	2433	60
Proposed	3.14	10	326	900



These pictures graphically illustrate realignment operations on the Redwood Highway north of Laytonville in Mendocino County. The upper four photographs show grading work in progress. The new and old alignments are shown in the left center picture. Below are views of the present highway showing two of 59 curves on the existing route, 49 of which will be eliminated.

JUSTUS CRAEMER APPOINTED TO HIGH STATE POSITION

THE Department of Public Works lost this month the valued services of Justus F. Craemer, Assistant Director.

Mr. Craemer resigned on October 4 to accept from Governor Frank F. Merriam appointment to the post of State Building and Loan Commissioner, succeeding Louis C. Drapeau, who was appointed to the Superior Court bench of Ventura County.

Serving from June to December, 1934, as private secretary to Governor Merriam, Mr. Craemer relinquished that office to become Assistant Director of the Department of Public Works.

NEWSPAPER PUBLISHER

Mr. Craemer is a newspaper publisher and orange grower of Orange County and for many years has been active in the newspaper field and in public life. As a former member of the State Agricultural Society, he was actively engaged with management of the State Fair for a period of years. He has served as president of the National Editorial Association and the California Newspaper Publishers Association. He brought to his job as Assistant Director of the Public Works Department a wide knowledge of California highways and an intense desire to expand the highway building program of this State.

A TRIBUTE

Typical of many tributes paid to him following his elevation to the office of Building and Loan Commissioner is the following from the column of Ed Ainsworth in the Los Angeles *Times:*

Along El Camino Real

Today's congratulations are equipped with reverse English.

Not to Justus Craemer for getting the job but to the State of California for having him in the job go felicitations for the appointment of the Orange whirlwind to be State Building and Loan Commissioner.

It will be difficult, though, to replace Craemer in his job as Southern California head of the



JUSTUS F. CRAEMER

State Public Works Department. He and District Engineer S. V. Cortelyou have carried on with large vision in the highway building program of this part of the State.

To them must go credit for the many major traffic-eluding arteries that skirt cities and link up the metropolitan areas in a closer bond.

The Holt-Garvey road to Pomona, the new Cerritos-San Gabriel cut-off from Coast Highway to the Pasadena area, the great time-saving parkway up the bed of the Arroyo Seco from downtown Los Angeles through the Figueroa tunnels, Imperial Highway and many others attest to the wisdom of their planning and doing.

Craemer has gone a step higher.

But he will go higher yet.

And there was the Scotchman who bought only one spur. He figured that if one side of the horse went the other was sure to follow.

Gov. Merriam Dedicates Capital Bridge Project

SIGNALIZING completion of a project financed by the State, the city and the county of Sacramento and the Federal government, Governor Frank F. Merriam, on Friday afternoon, October 1, formally dedicated and opened to traffic the new three-lane span approach to the I Street bridge across the Sacramento River and the Jibboom Street Viaduct, a grade crossing undertaking connecting with the I Street bridge.

The Jibboom Street grade separation unit of the project, providing an overhead crossing of the Southern Pacific Railroad yards, was constructed by the State Division of Highways at a cost of $169,250. It affords a direct connection from the I Street structure with the American River bridge connecting via the Garden Highway to Yuba City and Marysville with U. S. 99E and via North Sacramento with the Auburn-Lake Tahoe Highway, U. S. 40.

PROJECT COST $300,000

The new I Street bridge approach was built with funds provided jointly by the city and county of Sacramento and the Federal government. The entire project cost approximately $300,000. The Southern Pacific spent $17,000 to relocate its railroad tracks and the Pacific Gas & Electric Company participated to the extent of $12,000 expended in moving its street car tracks from Third and I streets to the entrance to the Southern Pacific depot.

In addition to the benefits which will be derived from the grade separation feature, the new combination structure will greatly improve the Sacramento entrance to the I Street bridge used jointly by the Southern Pacific and vehicular traffic, the latter being accommodated on the upper deck.

The old vehicular approach from I Street was only 18 feet in width between curbs and had two sharp angle turns and an abrupt change of grade at top and bottom. The new approach from Third Street has a width of 34 feet with a sight distance of more than 500 feet. The maximum gradient is 6 per cent. There are

two 5-foot sidewalks on the Third Street unit.

GOVERNOR CUTS RIBBON

A program of speechmaking in which Federal, State, city and county officials, representatives of the Southern Pacific and Pacific Gas & Electric Company and the contractors who built the project preceded the cutting by Governor Merriam of a ribbon barrier stretched across the approach. The celebration was arranged by the Sacramento Downtown Improvement Association, which sponsored the combined bridge approach and grade separation undertaking and was responsible for the appropriations of the funds required for it.

John T. Skelton, president of the Association, was master of ceremonies. Musical numbers were furnished by the Sacramento Junior College Band.

As one of the speakers, Earl Lee Kelly, Director of the State Department of Public Works, paid a tribute

(Continued on page 21)





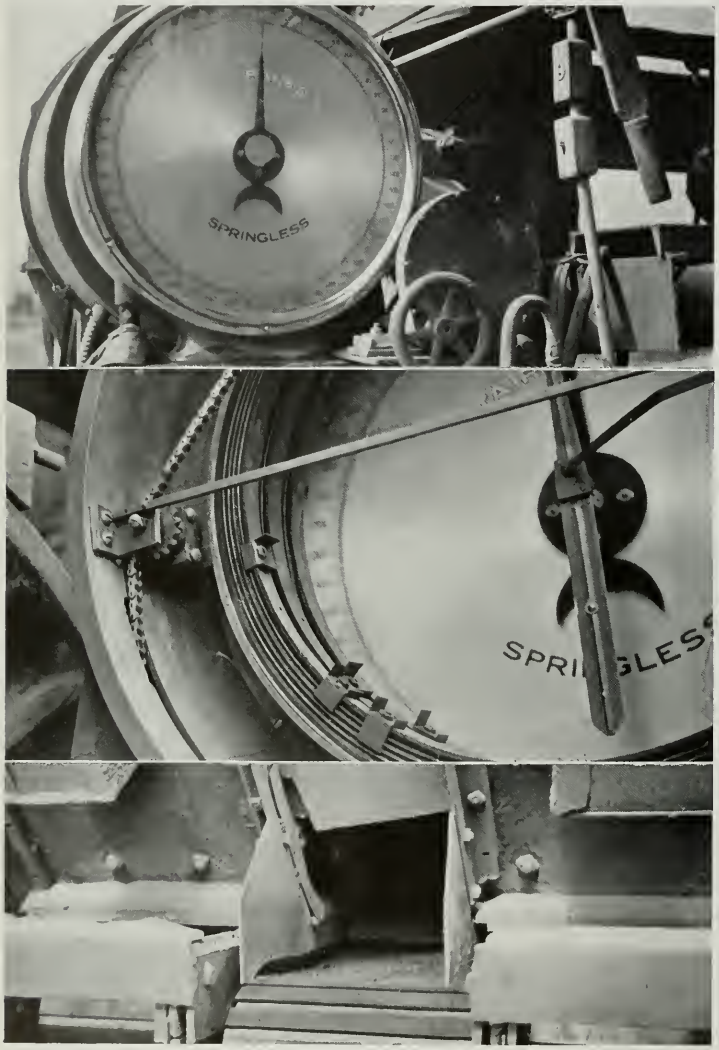
In the upper picture Director of Public Works Earl Lee Kelly and John T. Skelton, left, and Mayor Arthur Ferguson, extreme right, look on as Governor Merriam prepares to cut ribbon barrier across I Street Bridge approach in Sacramento, assisted by Miss Audrey McCormack and Miss Frances Leatherman. Lower—Panoramic view of I Street span and new approach and Jibboom Street Viaduct.

Abolish Curves on Route 79 in Ventura

(Continued from page 12)

This new alignment, adopted as a section of State highway Route 79, by the California Highway Commission, when entirely completed will eliminate the jog requiring traffic to follow a circuitous route at the city of Fillmore.

Route 79 for years has been the main highway for through traffic between Route 2 and Route 60 along the coast and Route 4 and Route 23 to inland points. There is also considerable local traffic between cities, towns and ranches in Ventura County.



Automatic weighing device for proportioning asphalt concrete mix which is being used on Ventura County highway project. Upper—Front view of dial. Wheel to line contact points at lower right of dial. Center—Rear view of control dial showing contact points and rings. Lower—Bin conveyor belt.

Previous to the awarding of the contract it was necessary to call for several contracts for the moving of houses within the newly acquired right of way and replace irrigation lines which were within the limits of the work.

On June 1, 1937, the contract was approved for grading and paving with asphalt concrete pavement for the amount of $94,934.65. Work was started by the contractor on June 14, 1937, and will be completed well within the allotted time of 150 working days.

AUTOMATIC WEIGHING SCALES

No unusual difficulties have come up on the work from a construction standpoint, the contractor receiving unlimited cooperation from the officials of the Rancho Sespe and the city of Fillmore. It was not necessary to carry traffic through the work during construction which speeded the work up considerably.

There was provided in the specifications for the contract automatic weighing proportioning scales for the asphalt concrete mix.

The automatic weighing device is operated entirely by electricity. The scales are of the springless dial type of 5000-pound capacity mounted on the platform to the left of the weigh box. The scales are very accurate and very easy to read.

ENDLESS BELTS OF STEEL

The material from the bins is taken away by endless belts made of steel. They are driven at the speed of 300 feet per minute by a one-horsepower motor with reduction gears, there being one motor for each bin or five in all. The starting and stopping is controlled by a series of contacts on copper rings mounted on the back of the scales.

There are three sets of these rings so that base, leveling course, and surface may be set up at one time. The

(Continued on page 21)

Rapid Progress Being Made on Altamont Pass

By JOHN H. SKEGGS,
District Engineer

PROGRESS on the construction of the Altamont Pass Highway in Alameda County, between Livermore and Tracy, has been rapid since the award of the contract on July 17, 1937.

The proposed construction and job statistics were described in the August number of CALIFORNIA HIGHWAYS AND PUBLIC WORKS.

Of a total of 1,900,000 cubic yards of required excavation to complete the project, approximately 500,000—or more than 25 per cent—has been removed to date. To remove this yardage the contractor has assembled seven 18-yard, three 12-yard and five 9-yard carryall scrapers, together with the necessary tractors, scarifiers and sheepsfoot rollers.

HEAVY EQUIPMENT

Four shovels and draglines are also busy at work, together with the complementary equipment of trucks, compressors and drilling outfits. Portable lighting and water systems have been installed, the lighting system being required for night work as a great deal of the work is being prosecuted in two shifts. The water is needed mainly for the watering and compaction of fills.

About 130 men per day are employed on the work.

The outstanding features of the grading equipment are the 18 cubic-yard carryall scrapers, loaded and hauled by huge diesel-powered tractors.

Progress on culvert installations, small concrete bridges, cattle passes and the concrete county road underpass at Greenville is well ahead of schedule and will not interfere with grading operations.

GRADE CROSSINGS

Since the award of the grading contract, a contract has also been awarded for the construction of an

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When new Altamont Pass Highway shown under construction in upper picture is completed there will be no traffic delays such as that shown in center picture and no traffic violations and hazards such as depicted on narrow Altamont bridge pictured below.

An Appreciation

Mr. Earl Lee Kelly,
Public Works Director,
Sacramento, Calif.

My dear Mr. Kelly:

While driving over the road between Lockport on the coast and the Redwood Highway, my brakes suddenly gave way. The road was narrow. I was going uphill, and was on the cliff side of the road. In some way which I do not yet understand, I missed the edge and backed into the bank, blocking the road. It happened at a place where a crew of your men was working. As my emergency and foot brake both gave up at the same time and there was no help until we reached the highway, our predicament was not a pleasant one.

The reason I am telling you of it is to let you know of the help your men gave us.

The foreman, Mr. Walter Severance of Fort Bragg, took us to a garage in his truck while Mr. Ernest Torstron drove my car. Mr. Severance used the truck as a brake for my car. He drove with the greatest care and we arrived safely at a place where we were able to get temporary repairs.

My mother and father and a young baby were with me and I dread to think of the trouble and anxiety I should have suffered had the men not been there—or been there and not helped us. All of them were most courteous and helpful—we were even offered hot coffee from their lunch boxes. If they are a fair sample of your road crews you must hand pick them and are certainly to be congratulated upon your discernment.

Most sincerely yours,

(Signed) MINA S. JOHNSON,
(Mrs. Fontaine Johnson),
H. Street Road,
Sacramento, Calif.

Bill—"My girl got her nose broken in three places."

Harry—"Well, she should keep out of those places."

RESTORE HIGHWAY BEAUTY



IN THE spring of 1929, a new highway, State Route 43, leading into the San Bernardino mountains was opened to traffic. This road is popularly known as the Rim of the World Highway.

A stretch of the highway loops around Panorama Point and in 1929, due to disastrous forest fires, presented a very denuded appearance. At that time District Highway Engineer E. Q. Sullivan, District VIII, promised that the loop would be beautified with trees.

These photographs show how that pledge was carried out. One, upper left, depicts Panorama Point as it looked in the summer of 1929 and the other two views give an idea of how the planting of trees along the length of the loop has restored the former natural beauty of this scenic route.

Gassing the Moles

By MILTON HARRIS, Associate Highway Engineer

A NEW use of automotive equipment has been discovered by District IX in a fight to eradicate the furry tunnelers of the genus scapanus, or moles as they are generally known. The small area of carefully tended grass adjacent to the District office has always been looked upon with pride as grass is scarce in a desert country.

Moles made their appearance, and for a while it looked as if this green plot was due to be their playgrounds in spite of poison, traps and a liberal flooding with water. On advice of the shop foreman, a truck was borrowed from the Equipment Department and a long hose slipped over the exhaust pipe so as to carry the carbon monoxide to various mole hills nearby. The exhaust end of the hose was buried in the hill and the motor started.

After running about twenty minutes, the hose was changed to another hole so that the gasses would carry through all the tunnels and eventually the burrows were entirely filled with gas and their occupants killed.

This method has proved to be very effective and its cost is negligible.



These pictures illustrate how moles were exterminated with monoxide gas by attaching one end of a hose to the exhaust pipe of a Division of Highways truck and poking the other end into mole hills.

Dedicate Capital Bridge Project

(Continued from page 17)

to Governor Merriam for the aid he gave to the project. Director Kelly said the undertaking was a fine example of the splendid spirit of cooperation existing between the State, municipal and county governments and the Federal government in such public undertakings.

Short talks were made by Mayor Arthur Ferguson, Congressman Frank H. Buck, W. L. Hack, divisional superintendent of the Southern Pacific Company; Wallace MacBain, president of the Sacramento Retail Merchants Association; P. M. Downing, vice president and general manager of the Pacific Gas and Electric Company; William O. Russell, chairman of the Yolo County Board of Supervisors; H. S. Lord of the contracting firm of Lord & Bishop, and County Executive Charles W. Deterding, Jr.

Route 79 in Ventura County is Realigned

(Continued from page 18)

contact is made by a hand or pointer which is in the same position as the pointer on the scale. The different rings are brought into line by a wheel mounted on the front of the scales. The operation is started by pushing a button on the switchboard. The button starts the first belt and when it reaches the required weight the pointer hits the first contact stopping the belt and starting the next in line. The sequence of the pulls may be changed at will by moving plugs in the switch box.

The switch board consists of two sets of switches, one set for automatic operation and one for testing the bins. They are wired so each bin can be tested at any time. The manual control is off when the switch is turned on to the automatic, and vice versa. At the time the weighing device was first put into operation several small mechanical kinks had to be taken out of it; however, after a few days the whole operation was practically perfect. Comparison weights were taken and the error of accuracy of 3000 pound box mixes averaged below five pounds.

Unquestionably another advance has been taken in the development of our California highways.

Highway Research Board to Meet

The Seventeenth Annual Meeting of the Highway Research Board of the National Research Council will be held in Washington, D. C., Tuesday, November 30 to Friday, December 3.

Papers and committee reports relating to highway finance, economics, design, materials and construction, maintenance, soils, roadside development and safety will be presented. This year the formal meeting of the board will be interspersed with open departmental meetings for informal discussion of pertinent topics.

Engineers Design Huge Gantry for Bridge



THIS strange steel giant was designed by engineers of the San Francisco-Oakland Bay Bridge for maintenance operations on the lower deck of the world's longest bridge.

The gantry weighs 8½ tons and is 18 feet 10 inches in height, high enough for trucks and buses to speed through it with ease. Its rubber-tired steel wheels run on opposite curbs of the three-lane deck, straddling a space sufficiently wide to permit the use by traffic of all three lanes simultaneously.

The large arm in the foreground is of aluminum, 27 feet in length, and when swung out on its huge hinges from the side of the gantry reaches over the remaining portion of the lower deck, over which the bridge's electric railway system will soon be operating.

This aluminum arm, or cantilever, is designed to clear the catenary of the electric trains so that schedules can be kept uninterrupted by painting or other maintenance operations.

To swing the cantilever out above the catenary, it is first raised to the position shown in the illustration, sufficiently high to clear the trolleys. From this position it can be swung through 90 degrees. Floor boards are then placed in position, forming a safe working platform.

Number of Vehicles Using Bay Bridge Passes 8 Million Mark

A TOTAL of 705,704 vehicles crossed the San Francisco-Oakland Bay Bridge during September, bringing the entire number of vehicles to cross the span during the ten months since it opened to 8,283,231, according to Earl Lee Kelly, State Director of Public Works.

High point of the month was Saturday, September 25, when 31,762 vehicles crossed the bridge, stimulated by the University of California-St. Mary's football game at Berkeley, Mr. Kelly said. Low point was Tuesday, September 28, with a total of 19,949 vehicles.

Daily average for the month was 23,523, bringing a total income for September of $377,344.65.

Comparative figures of August and September traffic over the Bay Bridge, as reported by State Highway Engineer C. H. Purcell, were announced by Mr. Kelly as follows:

	Passenger Autos	Auto Trailers	Motor-cycles	Tri-cars	Trucks
Total Aug.	807,670	2,460	3,691	780	27,737
Total Sept.	663,520	1,689	2,994	772	25,993

	Truck Trailers	Buses	Total Vehicles	Extra Passengers	Freight Lbs.
Total Aug.	1,408	9,833	853,579	209,620	69,082,335
Total Sept.	1,274	9,462	705,704	173,144	64,446,664

The Lady Remarketh: "Hobo, did you notice that pile of wood in the yard?"

"Yes'm, I seen it."

"You should mind your grammar. You mean you saw it."

"No'm. You saw me see it, but you ain't seen me saw it."

National Highway Officials Honor Chas. H. Purcell

CALIFORNIA'S State Highway Engineer, Charles H. Purcell, Chief Engineer of the San Francisco-Oakland Bay Bridge, was elected president of the American Association of State Highway Officials



C. H. PURCELL

at the organization's convention in Boston this month.

Mr. Purcell was a member of the association's national executive committee of ten, and was host at its 1936 convention in San Francisco.

Already a nationally recognized authority on public highways the appointment adds to a long string of honors, which includes an appointment by Secretary of Agriculture Henry Wallace to a special committee for the consideration of administrative design policies for rural roads, and appointment by President Franklin D. Roosevelt as a United States representative to the Permanent International Association of Road Congresses.

"That man wants me to lend him some money. Do you know anything about him."

"Why, I know him as well as I know you. Don't lend him a bean, old man."

IMPROVED ROCK SIEVER

A CONVENIENT rock shaker of simple design, sturdy construction and light weight has recently been developed by Resident Engineer E. L. Seitz, in District VII.

The double rocker and base upon which the conventional screen frames are nested, were constructed from two 18-inch discs salvaged from a pavement planer. The lower disc acts as a base upon which the upper disc can be rocked in any desired direction. The discs are held in position by means of a bolt passing through their centers, and a valve compression spring provides adjustment to limit the rocking motion. Four one-inch tubes, welded to the upper disc and braced by a ¾-inch rod connecting them at a point about 6 inches above the disc, hold the nest of screen frames in place.

The most effective screening action is obtained by giving the top of the frames a circular motion approximately one foot in diameter at the rate of fifty to sixty revolutions per minute. This action gives the rock particles a gentle rolling action across the screen surface, and allows the particles smaller than the respective screen openings to pass through without wedging into or clogging the screen openings.

Being compact and light in weight, the whole assembly can be easily moved and transported from job to job. Use of the double rocker permits the shaker to be set up and operated on sandy or gravelly ground. Very little effort is required to operate the shaker, and screenings are made in a minimum of time.



Seitz rock shaker in operation.



Showing construction of shaker.

Highway Leaders to Meet

"Building safer highways, and not simply more highways" is the keynote for the statewide meeting of highway officials and business leaders to be held in Los Angeles October 28 and 29, as expressed by Hubert M. Walker, Chairman of the Highway Committee of the California State Chamber of Commerce, who will preside at the Highway group.

Speakers at the meeting will be Earl Lee Kelly, Director, Department of Public Works; C. H. Purcell, State Highway Engineer; Harry Mitchell, Chairman of the State Chamber Highway Safety Committee; Roger Jessup, Los Angeles County supervisor; Dr. L. I. Hewes, Director Federal Bureau of Public Roads.

A Southern father was introducing his family of boys to a visiting Governor.

"Seventeen boys!" exclaimed the Governor. "And all Democrats, I suppose?"

"All but one," said the father proudly. "They're all good Democrats but John, the little rascal. He got to readin'."

Public Asked to Help in Stopping Destruction of Highway Signs

AN ALARMING increase in the damage done to State highway signs during the last three months by vandals caused Director of Public Works Earl Lee Kelly to issue an appeal to the citizens of California to cooperate with the Division of Highways and the California Highway Patrol in bringing about the arrest and prosecution of persons responsible for destroying hundreds of important highway safety signs.

Director Kelly called attention to the fact that the vehicle code provides for a maximum sentence for defacing highway signs of $500 fine and six months in jail or both. He said that the damage to signs from bullet holes is becoming a factor that is seriously reducing the efficiency of these signs and in many cases results in the complete loss to the public and the endangering of human life.

VANDALS ENDANGER LIFE

He said that a recently signed U. S. numbered route was inspected two weeks after the numbered shields were installed and all but one shield in a stretch of forty miles had been pierced by bullets. One reflector erected to warn motorists of a dangerous "S" curve and concrete culvert on the Jack Tone Road two miles south of Lockeford in San Joaquin County was blasted with 14 bullets and 47 of 51 reflectors were pried from the sign, making its warning message virtually nonvisible to night drivers.

In many sections of the State, Director Kelly declared, the defacing and destruction of highway signs is increasing to an alarming extent. He urged that every citizen who witnesses the defacing of a highway sign immediately report the person responsible to the nearest peace officer and assist in the prosecution of the offender.

SIGNS EXPENSIVE

Kelly stated, "The highways of the State of California are well signed. These signs are placed at great expense to enable motorists, particularly strangers, to travel with safety. They are signs paid for by the people out of the gasoline tax and motor vehicle registration funds.



EARL LEE KELLY

"There are some people using our highways who apparently think these signs were placed for target practice. The damage to these signs from bullet holes is becoming a serious problem to the Division of Highways. The Division of Highways has made a study of this vandalism to determine when the greatest damage occurs. Its studies show that very little if any damage is done during hunting season.

"The greatest damage is done with 22 caliber cartridges and during the months of June, July, and August. Are we to assume, then, that vacationists are doing this damage to our signs?"

DUTY OF CITIZENS

"Only an aroused public opinion will stop this vandalism. I consider it to be the duty of every citizen who witnesses such an act of vandalism to cooperate with the Division of Highways in prosecuting the guilty person or persons and I appeal to the men and women of California who believe in highway safety to assist us in putting an end to this condition menacing to life and property on our highways.

"Not only is life and property on our highways endangered by the destruction of highway signs, but the cost of replacing a mutilated sign equipped with reflectors costs the people of this State $8 and the monetary cost to the State of this vandalism is considerable.

"An aroused citizenry, cooperating with the Division of Highways and the California Highway Patrol, will put an end to the useless destruction of highway signs."

Progress Made on Altamont Pass

(Continued from page 19)

overpass over the tracks of the Southern Pacific and the Western Pacific Railroads at Greenville, and bids will shortly be taken for the construction of crossings over the same railroads about four miles easterly of Greenville. These grade separations will be scheduled for completion at approximately the same time as the grading project, and it is expected that the highway will be opened for traffic in September of next year.

The Altamont Pass contracts and the contractors to whom they have been awarded are:

Mountain House to Greenville (Road Contract 04TC2) Granfield, Farrar and Carlin, San Francisco. Awarded June 21, 1937.

Greenville Overhead. Contract 014GTC1, A. J. Raisch, San Jose. Awarded September 23, 1937.

Redmond overhead over Southern Pacific Railroad, Stone cut subway under Western Pacific Railroad, 014GTC1, A. J. Raisch, San Jose. Fredrickson Watson Construction Co. and Fredrickson Bros.

Highway Bids and Awards for September, 1937

ALAMEDA COUNTY—A reinforced concrete girder overhead crossing over the tracks of the Southern Pacific Railroad and the Western Pacific R. R. at Greenville, consisting of one 50-foot 6-inch span, eight 49-foot spans and one 16-foot cantilever. District IV, Route 5, Section E. C. W. Caletti and Co., San Rafael, $117,239. John Rocca, San Rafael, $113,707; J. F. Knapp, Oakland, $109,807; Carl N. Swenson Company, San Jose, $109,196.40; R. R. Bishop, Long Beach, $108,690. Contract awarded to A. J. Raisch, San Jose, $104,269.50.

COLUSA COUNTY—Between Genevra and 2.7 miles north, 2.7 miles to be surfaced with road-mix surfacing. District III, Route 7, Section B. Hemstreet and Bell, Marysville, $8,460; A. Teichert and Son, Inc., Sacramento, $13,280; George French, Jr., Stockton, $9,845; Tieslau Bros., Berkeley, $9,759; Granite Construction Co., Ltd., Watsonville, $10,455; Ernest E. Smith, Eureka, $8,895; Helwig Construction Co., Sebastopol, $9,830; Frank Embleton, Albany, $11,650; M. J. B. Construction Co., Stockton, $12,985. Contract awarded to Garcia Construction Co., Irvington, $7,645.

EL DORADO COUNTY—Between 1.25 miles west of El Dorado and Clarks Corner about 4.3 miles in length, to be graded and surfaced with plant-mixed surfacing. District III, Route 11, Section C. Isbell Construction Co., Reno, Nev., $250,525; Harold Blake, Portland, Ore., $258,800; George Pollock Co., Sacramento, $185,168; Union Paving Co., San Francisco, $195,240; George K. Thompson and Co., Los Angeles, $188,151; Louis Biasotti and Son, Stockton, $199,498; N. M. Ball Sons, Berkeley, $191,399; McNutt Brothers, Eugene, Ore., $204,088; A. Teichert & Son, Inc., Sacramento, $185,821; Heafey-Moore Co. & Frederickson & Watson Construction Co., Fredrickson Bros., Oakland, $178,431; Macco Construction Co., Clearwater, $169,495; Fredericksen & Westbrook, Lower Lake, $179,085; Pacific States Construction Co. and Young and Son Co., Ltd., San Francisco, $179,085; Pacific States Construction Co. & Young and Son Co., Ltd., San Francisco, $179,419; Chas. L. Harney, San Francisco, $246,894. Contract awarded to Hemstreet and Bell, Marysville, $163,731.25.

HUMBOLDT COUNTY—Repairs to existing timber bridge across Big Lagoon about 10 miles north of Trinidad. District I, Route 1, Section J. F. Kaus, Stockton, $39,699; M. A. Jenkins, Sacramento, $43,327; W. K. Van Bokkelen Construction, Oakland, $43,595; F. J. Maurer & Sons, Inc., Eureka, $44,092; John Rocca, San Rafael, $48,224; Mercer, Fraser Co., Eureka, $49,902; Alford H. Vogt Co., Inc., San Francisco, $52,697. Contract awarded to N. M. Ball Sons and E. E. Smith, Berkeley, $38,969.

LASSEN COUNTY—Between Coppervale and Susan River, about 7.1 miles to be graded and surfaced with crusher run base and plant-mixed surfacing. District II, Route 29, Section B. Union Paving Co., San Francisco, $237,666; Heafey-Moore Co. & Fredericksen Watson Construction Co. Fredricksen Bros., Oakland, $226,734; D. W. Thurston, Los Angeles, $220,097; Hemstreet & Bell, Marysville, $220,581; George K. Thompson and Company, Los Angeles, $206,698; George Pollock Company, Sacramento, $240,711; Isbell Construction Co., Reno, $276,234; Macco Construction Co., Clearwater, $225,743; McNutt Brothers, Eugene, Ore., $226,562; Fredericksen and Westbrook, Lower Lake, $221,874; Harms Bros., Litchfield, $239,699. Contract awarded to Mountain Construction Co., Sacramento, $198,757.50.

LOS ANGELES COUNTY—Between Summit and Palmdale, about 14.6 miles Class "B" seal coat to be applied to existing shoulders. District VII, Route 23, Sections D, E. Griffith Co., Los Angeles, $7,545; Dimmit and Taylor, Los Angeles, $7,630; A. S. Vinnell Co., Alhambra, $8,190; Vido Kovacevich, South Gate, $8,352; P. J. Akmadzich, Los Angeles, $8,466. Contract awarded to Oswald Bros., Los Angeles, $7,310.

LOS ANGELES COUNTY—In Monterey Park, between Atlantic Blvd. and New Ave., about 1.0 mile to be surfaced with asphaltic concrete. District VII, Route 26, Section Mon.P. D. W. Thurston, Los Angeles, $49,705; W. E. Hall Co., Alhambra, $47,794; C. O. Sparks & Mundo Engineering Co., Los Angeles, $50,320; Griffith Co., Los Angeles, $46,865; Oswald Bros., Los Angeles, $48,216; J. E. Haddock, Ltd., Pasadena, $51,885. Contract awarded to George R. Curtis Paving Co., Los Angeles, $44,875.20.

MENDOCINO COUNTY—At Dry Creek between McDonald and Yorkville, about 1.2 miles in length, a reinforced concrete grider bridge and approaches to be constructed and approaches to consist of a graded roadbed with a penetration oil treatment applied thereto. District I, Route 48, Section A. W. K. Van Bokkelen, Construction, Oakland, $39,450; Peter J. McHugh, San Francisco, $45,233; John Rocca, San Rafael, $37,007; N. M. Ball Sons, Berkeley, $36,566; Rock and Gravel Trucking Co., Oakland, $32,936; Chas. L. Harney, San Francisco, $43,961; Claude C. Wood, Stockton, $31,470; Guerin Bros., San Francisco, $33,004. Contract awarded to Harold Smith, St. Helena, $30,417.

MERCED COUNTY—Between Los Banos and 10.5 miles east, about 10.5 miles armor coat to be applied to the existing pavement and borders. District X, Route 32, Section C. Granite Construction Co., Ltd., Watsonville, $46,976; Jones and King, Hayward, $48,496; E. A. Forde, San Anselmo, $48,739; Piazza and Huntley, San Jose, $48,943; Independent Construction Co., Ltd., Oakland, $50,757; A. J. Raisch, San Jose, $51,506; Claude C. Wood, Stockton, $59,886; Basich Brothers, Torrance, $65,023. Contract awarded to J. A. Casson, Hayward, $43,761.25.

ORANGE COUNTY—Between Center Street and Placentia Avenue, about 0.3 miles grading and surfacing with Portland cement concrete. District VII, Route 178, Section A. Griffith Co., Los Angeles, $12,956; Sully-Miller Construction Co., Long Beach, $13,803; J. E. Haddock, Ltd., Pasadena, $12,591; Matich Bros., Elsinore, $13,021; C. O. Sparks, Los Angeles, $14,078. Contract awarded to Oswald Bros., Los Angeles, $12,410.

ORANGE COUNTY—Hampshire Ave. between Coast Blvd. and Garfield St., about 2.6 miles to be graded and paved with Portland cement concrete. District VII, Route 171, Section A.Hnt.B. Sully-Miller Contracting Co., Long Beach, $102,625; D. W. Thurston, Los Angeles, $99,628; Macco Construction Co., Clearwater, $99,678; Matich Bros., Elsinore, $98,463; Daley Corp., San Diego, $98,143; E. Paul Ford, San Diego, $99,878; Southern California Roads Co., Los Angeles, $98,234; N. M. Ball and Sons, Berkeley, $101,971; Claude Fisher Co., Ltd., Los Angeles, $103,117; C. O. Sparks and Mundo Engineering Co., Los Angeles, $106,093; George R. Curtis Paving Co., Los Angeles, $109,689; Griffith Co., Los Angeles, $103,078; Oswald Bros., Los Angeles, $99,799; L. A. Paving Co., Los Angeles, $142,345. Contract awarded to J. E. Haddock, Ltd., Pasadena, $96,618.50.

PLACER COUNTY—Between Gold Run and Airport, various locations, about 2 miles to be surfaced with roadmix surfacing. District III, Route 37, Section D. Garcia Construction Co., Irvington, $14,382; A. Teichert and Son, Inc., Sacramento, $16,902; Granite Construction Co., Ltd., Watsonville, $17,951; Piazza and Huntley, San Jose, $14,981. Contract awarded to Fredericksen and Westbrook, Lower Lake, $14,330.

SACRAMENTO COUNTY—On Folsom Boulevard in the city of Sacramento between 64th and 65th Streets, maintenance station buildings and appurtenances to be constructed. District III, Route 11, Section Sacramento. Campbell Construction Co., Sacramento, $22,969; Holdener Construction Co., Sacramento, $24,370. Contract awarded to M. R. Peterson, Sacramento, $22,755.10.

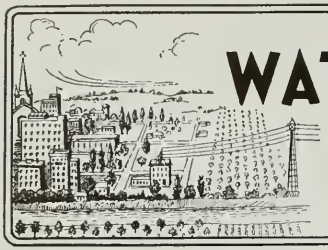
SAN BENITO, MONTEREY, SAN LUIS OBISPO, SANTA BARBARA COUNTIES—At various locations, about 705 miles of traffic stripe to be applied to existing pavement. District V, various routes and sections. Al. W. Simmonds, Sacramento, $3,694. Contract awarded to S. A. Cummings, San Diego, $3,662.75.

DISTRICT III—Various locations, about 510 miles of traffic stripe to be applied to existing pavement. Edwin Anderson, San Francisco, $3,213. Contract awarded to Albert W. Simmonds, Sacramento, $2,640.

SAN BERNARDINO COUNTY—Between Amboy and Essex, and between Vidal and Needles, about 82.4 miles in length, seal coat to be applied to existing roadbed. District VIII, Routes 58 and 146, Sections K, L. A. B. C. D. J. A. Casson, Hayward, $21,575; R. E. Hazard and Sons, San Diego, $24,120; George Herz and Co., San Bernardino, $21,389; W. R. Shriver, Los Angeles, $24,120; A. S. Vinnell Co., Alhambra, $24,627. Contract awarded to Geo. Gardner and Sons, Redlands, $19,830.

SAN BERNARDINO COUNTY—A reinforced concrete slab bridge across Cable Creek, 7 miles north of San Bernardino, consisting of two 21-foot spans and one 24-foot span on concrete bents and about 0.2 mile of roadway approaches to be graded and surfaced with plant-mixed surfacing. District VIII, Route 191, Section A. Martin Green, San Bernardino, $15,670; Claude Fisher Co., Ltd., Los Angeles, $13,477; J. R. Lippincott, Los Angeles, $14,938; J. E. Haddock, Ltd., Pasadena, $13,531; Geo. Herz and Co., San Bernardino, $13,400; Oscar Oberg, Los Angeles, $16,684; Dimmitt and Taylor, Los Angeles, $13,869. Contract awarded to Oswald Brothers, Los Angeles, $13,326.

SANTA BARBARA COUNTY—Between Santa Barbara and Stony Creek, between Tajiguas and ¾ mile west of Arroyo Hondo, and between Alcatraz and Gaviota Creek, about 12.8 miles, roadbed to be widened and shoulders to be treated with liquid asphalt. District V, Route 2, Sections P, K, F, E, L. A. Brisco, Arroyo Grande, $10,365; J. E. Haddock, Ltd., Pasadena, $11,241.50. Contract awarded to Granite Construction Co., Ltd., Watsonville, $9,971.30.



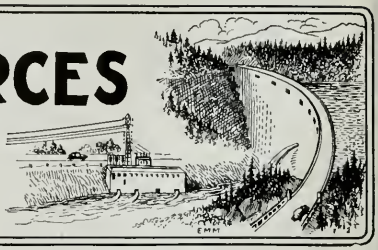
DIVISION OF WATER RESOURCES

OFFICIAL REPORT

FOR THE MONTH OF

September, 1937

EDWARD HYATT, State Engineer



IRRIGATION DISTRICTS

The Shafter-Wasco Irrigation District, comprising an area of 42,000 acres in Kern County, northwest of Bakersfield, was organized at an election held September 3d. This is the fourth irrigation district to be organized on the line of the Friant-Kern Canal for the purpose of contracting for supplemental water supplies from the Central Valley Project.

Oakdale Irrigation District has filed application for additional storage on Stanislaus River below the present Melones Reservoir. The proposed development is part of an irrigation and power project that would provide the district with a more dependable late summer water supply.

Tulare Irrigation District has called for bids for construction of a siphon under St. John's River, east of Visalia. The structure would replace the present flume crossing at that point which is inadequate in size to carry the district's irrigation requirements.

Excavation work on the All-American Canal in Imperial District is now 97 per cent completed. The portion finished has a length of 76.8 miles. The structural work is all under contract and the canal is expected to be supplying water in another year.

FLOOD CONTROL AND RECLAMATION

Maintenance of Sacramento Flood Control Projects.

During this period routine maintenance has been performed with a small regular crew. At the Butte Slough Outfall Gates, the seven 66-inch gates, gate stands and tide gates have been cleaned and painted. Smaller drainage ditches in the Sutter system have been cleaned by hand of tules and other vegetable growth.

On the south levee of the Sacramento Bypass a section 300 feet long has been puddled by impounding pumped water on the crown and face. A compaction or subsidence as much as four feet at the crown was secured. It is felt that the levee will be safe in the future after it has been brought to full section with additional material.

Relief Labor Work.

During this period no relief labor has been available for work on the flood control project. It is expected that the program will be resumed to some extent about October 15th.

SACRAMENTO FLOOD CONTROL PROJECT

At the request of the Reclamation Board, the division is now engaged in construction of an irrigation canal in the vicinity of the Colusa By-pass, at an estimated cost of $12,000; and filling the borrow pit on Burr Mitchell property on the right bank of the Sacramento River north of Colusa, at an estimated cost of $24,000. Both of these units will be let to contract.

Examinations have been made of a number of works, the plans for which have previously been approved by the Reclamation Board, consisting mostly of structures in the project levees.

Flood Measurements and Gages

The work of collecting and arranging data for the flood season of 1936-37 has continued. The gaging stations at Mawson bridge in the Butte Slough By-pass and at Gridley on the Feather River are being improved with the installation of new continuous water stage recorder instruments, with new houses.

WATER RIGHTS

Supervision of Appropriations of Water.

Thirty-eight applications to appropriate water were received during August; ten were denied and twenty were approved during the month. Two permits were revoked and the rights under ten permits were confirmed by the issuance of licenses.

Among the larger and more important applications filed were two by Oakdale Irrigation District looking toward the development of 120,000 acre-feet additional storage capacity on Stanislaus River a short distance below the present diversion dam of Oakdale and South San Joaquin Irrigation Districts. The stored waters are to be used for power, irrigation, and domestic uses in the Oakdale Irrigation District. The estimated cost of the development is $4,000,000.

Projects were inspected during the month in Mono, Mariposa, Glenn, Butte, Yuba, and Sutter Counties.

SUPERVISION OF DAMS

Application was filed on August 24, 1937, for approval of plans and specifications for the construction of Bean Hollow No. 2 Dam of the Shoreland Properties, Inc. This is to be an earthfill structure 30 feet in height with a storage capacity of 600 acre-feet, on the Arroyo De Los Frijoles in San Mateo County. The estimated cost is $7,200,000.

Application was filed on September 8, 1937, for approval of plans and specifications for construction of Evans Creek Dam of the Tuolumne Gold Dredging Corporation. This is to be an earth dam 25 feet in height with a storage capacity of 200 acre-feet, situated on Evans Creek, Stanislaus County. The estimated cost is $2,000.

Application was filed on August 19, 1937, for approval of plans for repair and alteration of French Lake Dam of the Nevada Irrigation District. This application was approved on September 13, 1937. Work consisting of replacing the facing on the dam is progressing satisfactorily.

Application for approval of plans for the alteration of Cardoza Dam of the Tuolumne Gold Dredging Company was approved on August 23, 1937.

SACRAMENTO-SAN JOAQUIN WATER SUPERVISION

During the past month members of the staff engaged in this work have been in the field gathering data from which to record the amount of water diverted from streams in the Sacramento and San Joaquin Valleys. This report will also show the irrigated acreage, the return flow therefrom, and the flow in the valley streams. Sampling of water in the delta is being carried on at a number of stations sufficient to record the rate of advance of the salinity. At intermittent intervals samples of drainage and return flow water are being obtained in the Sacramento and San Joaquin Valleys.

CENTRAL VALLEY PROJECT

The United States Bureau of Reclamation continued work during the month on the construction of the government camp at Friant Dam and awarded contracts for the construction of a number of buildings at the Kennett camp for the Shasta Dam, formerly called the Kennett Dam. The Bureau has also continued work on surveys and the preparation of plans necessary for starting construction on several initial units of the project.

The Division of Water Resources has continued surveys and investigations in the San Joaquin Valley preliminary to the preparation of agreements for the acquisition of lands and water rights and the exchange of water, and has continued negotiations for rights necessary for the initiation of construction of the project.

New Flood Gate

By H. E. KUPHAL, Associate Bridge Engineer

IT IS interesting to a visitor in Sacramento to note that all the older residences were built with a basement floor level with the street and with steps leading from the sidewalk to the second floor. This was due to the city being flooded almost every winter or sometimes several times during the rainy reason. The citizens promptly moved upstairs and did their shopping and visiting in boats.

This flooding was due to the city being located at the confluence of the Sacramento and the American Rivers on a low flood plane. Now the city is almost completely surrounded by levees.

These levees in some instances are used by the railroads for their embankments providing an ideal approach to the city. Where the highways pierce these levees, gates must be provided to close the gaps during flood periods.

In the past these gates were built of structural steel; plates riveted to structural frames, hinged to abutments which were built in the ends of the levees and when closed meeting at an angle pointing toward the rising waters. Thrust due to the water pressure was resisted by these abutments.

These steel gates are cumbersome to handle and difficult to seal adequately.

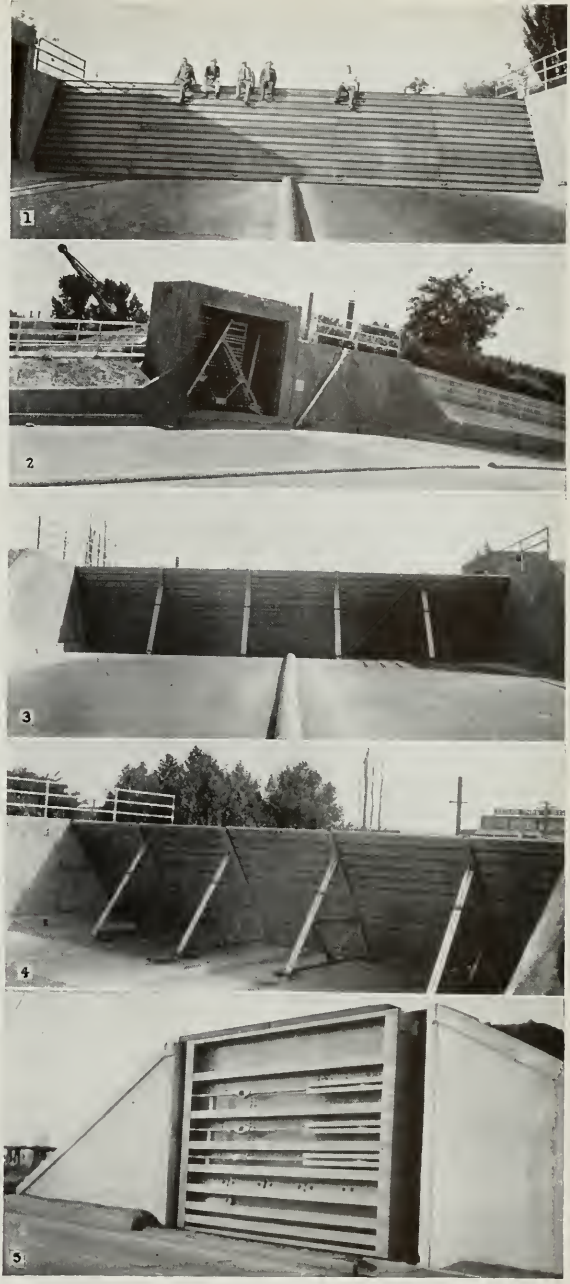
When the Sixteenth Street Subway, which penetrates the levee under the Southern Pacific tracks, was widened the steel gates with their supporting abutments had to be abandoned and a new gate installed. It was decided to build a new type in the form of a movable or portable dam.

In determining the material to be used, the question of strength and weight had to be considered and material capable of withstanding a load of 650 pounds per square foot at the bottom of the dam and light enough so that individual units could be handled readily by one man was required.

Structural aluminum alloy solved the problem. This material now obtainable in structural shapes is one third as heavy and fifty percent stronger than structural steel. Although the gate itself cost more than the swinging steel type, a saving in the abutments balanced the total cost, as in this type the water pressure is carried through the "A" frames directly into the pavement instead of laterally to the abutments.

Among other advantages of this new type of gate is the fact that the abutments are built without any unsightly gates in view which require oiling and painting, and there is no groove across the roadway to facilitate sealing, covered by a plate which always rattles under a passing car.

Four aluminum alloy "A" frames are set across the roadway with their rear legs set in recesses in the pavement. On the front of these, 10-inch structural aluminum channels are laid. These channels are all faced on one edge with a special rubber strip which completely seals adjacent channels against leakage, a notch parallel to the front face of the "A" frames in the abutments supporting the ends of the channels.



1—Flood gate from river side showing aluminum sections in place. 2—View of storage compartment with door open, showing aluminum sections as stacked when not in use. 3—Rear view showing aluminum gate in place. 4—Closeup of rear of flood gate. 5—Showing conventional design of flood gate.

New Policy in Signing on U. S. Number Routes

(Continued from page 13)

In connection with the U. S. numbering plan, as evolved and perfected, it has been found necessary and expedient to recognize and establish "Business Routes," "By-pass," "Alternate Routes," and "Temporary Routes," which have been defined as follows:

BUSINESS ROUTE

A "Business Route" is a route principally within the corporate limits of a city which provides the traveling public an opportunity to travel through that city, passing through the business part of the city; while the regular number is used to obviate passing through the congested part of the city. This "Business Route" connects with the regular numbered route at the opposite side of the city limits.

"Business Route" numbering shall be established by the placing of a standard strip carrying the words "Business Route" on the staff above the U. S. shield.

BY-PASS

A "By-pass Route" is a route which is established for the purpose of designating a route which entirely by-passes a city and joins in with the regular numbered route beyond the city. This enables the regular number to be carried through the city and the regular number to be carried through the country near the city.

The "By-pass Route" shall be designated by the erection of a standard strip on the staff carrying the U. S. shield, on which is the word "By-pass."

ALTERNATE ROUTE

An "Alternate Route" shall be considered a route which starts at a point where it branches off from the main numbered route, may pass through certain cities and towns, and then connects with the regular number some miles distant. This optional routing is provided for the purpose of eliminating lettered U. S. numbers which have been established but can not be absorbed into some new route.

An "Alternate Route" shall be marked by the erection of signs bearing the same U. S. number as the main route and above the shield shall carry a standard strip with the words "Alternate Route."

TEMPORARY ROUTE

In the erection of signs for numbering routes, it is necessary in some cases to carry a number temporarily over a road that ultimately will not be the permanent location of that number. Great care should be taken by the State Highway Departments in seeing that when numbers of this character are permitted, that a standard strip carrying the words "Temporary Route" shall be placed on the staff above the number. This will obviate much hard feeling when it is necessary to change a number to the permanently established route.

The word "Temporary" on a standard strip above the regular U. S. numbered shield should also be used where it is necessary to establish a detour.



In Memoriam

John J. Haley, Jr.

The death of John J. Haley, Jr., on October 2, 1937, brings to an untimely end one of the most beloved and highly esteemed officials of the Department of Public Works.

Born in Lincoln, Nebraska, on August 1, 1884, and after his boyhood days, moving to Colorado where he attended high school and college and won high honors, Mr. Haley upon completion of his scholastic training started his career in railroad engineering. His early work took him into Arizona, Texas, California and Mexico. From 1907 to 1909, he was assistant engineer on the construction of the electric railway system in Los Angeles and vicinity. From there he went to the Imperial Valley and worked as materials and purchasing agent and irrigation engineer for the California Development Company until 1912.

Mr. Haley came to northern California in 1913 and his work during the next seven years was chiefly on reclamation and flood control developments in the Sacramento Valley, as engineer and construction superintendent, and for two years in private business of engineering and contracting. From 1921 to 1922, he was employed successively as Assistant State Purchasing Agent and Purchasing Agent for the City of Sacramento.

The success that Mr. Haley attained in these years of varied activity was but the prelude to the greater accomplishments which crowned his career during his service with the State. Starting in 1922, he was employed as Assistant to the Chief of the Division of Irrigation and Engineering for four years, was promoted to Deputy Chief in 1926, and then to Administrative Assistant to the Chief of the Division of Water Resources since 1929.

Throughout the fifteen years in responsible charge of the management and administration of the organization and activities under the State Engineer, Mr. Haley achieved unusual success. His ability and genius as an executive official have been outstanding. He was not only peculiarly fitted by training and experience, but also was gifted with a most winning personality and a temperament admirably suited to his adminstrative duties.

Unusually industrious and efficient, thoroughly dependable, gentle but firmly spoken, always kindly and considerate, generous, unselfish, and ever cheerful and genial of disposition—these but feebly describe the qualities Mr. Haley possessed which won for him the respect, admiration, confidence and friendship of all with whom he came in contact.

To the State and the Division of Water Resources of the Department of Public Works, Mr. Haley's death is an immeasurable loss. To his associates and host of close friends who held for him the greatest affection and esteem, his passing brings a profound sense of loss and deepest regret. These join in extending heartfelt sympathy to his beloved wife and family in their bereavement.

STATE OF CALIFORNIA

Department of Public Works

Headquarters: Public Works Building, Twelfth and N Streets, Sacramento

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EDWARD J. NERON_____Deputy Director

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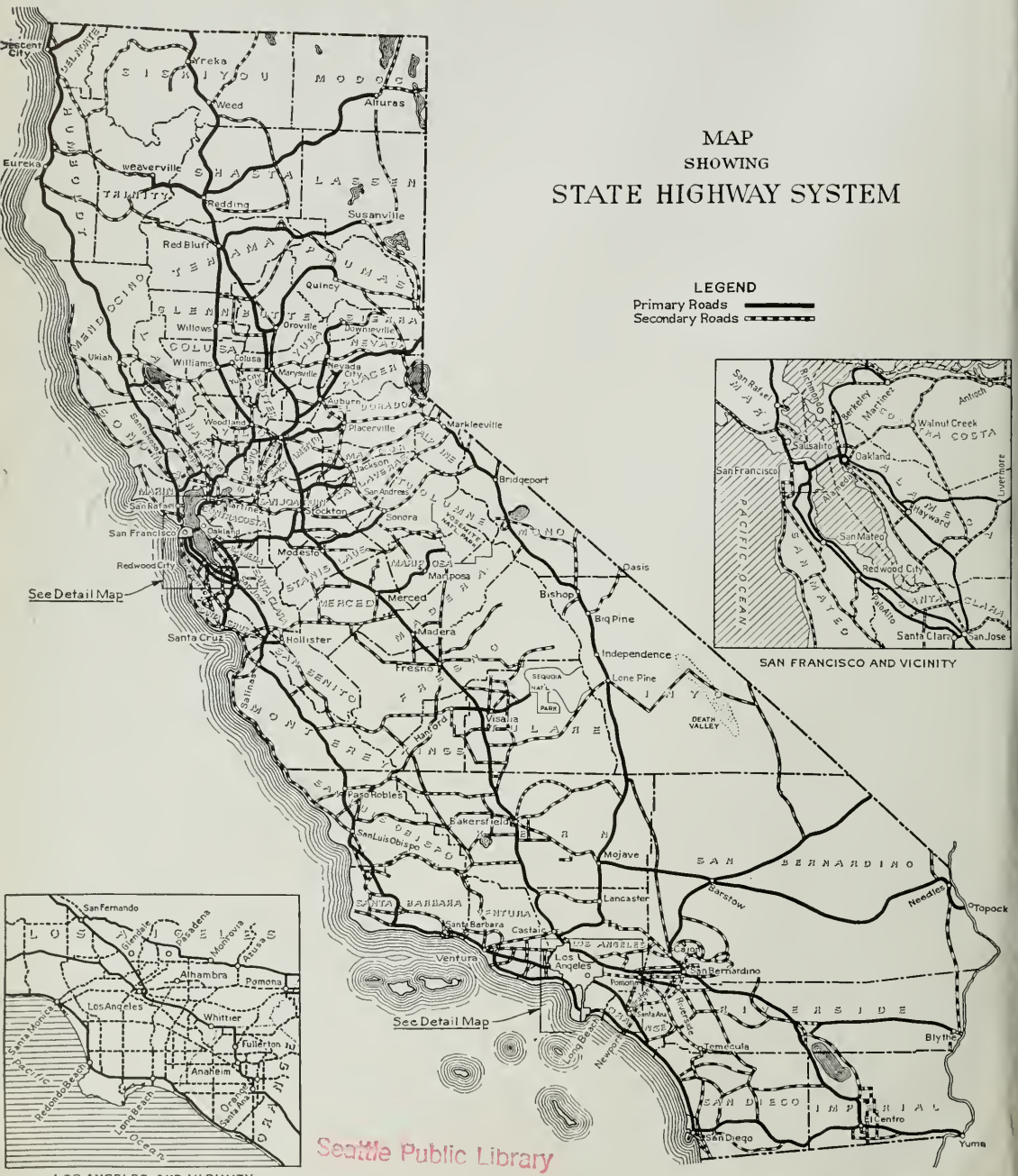
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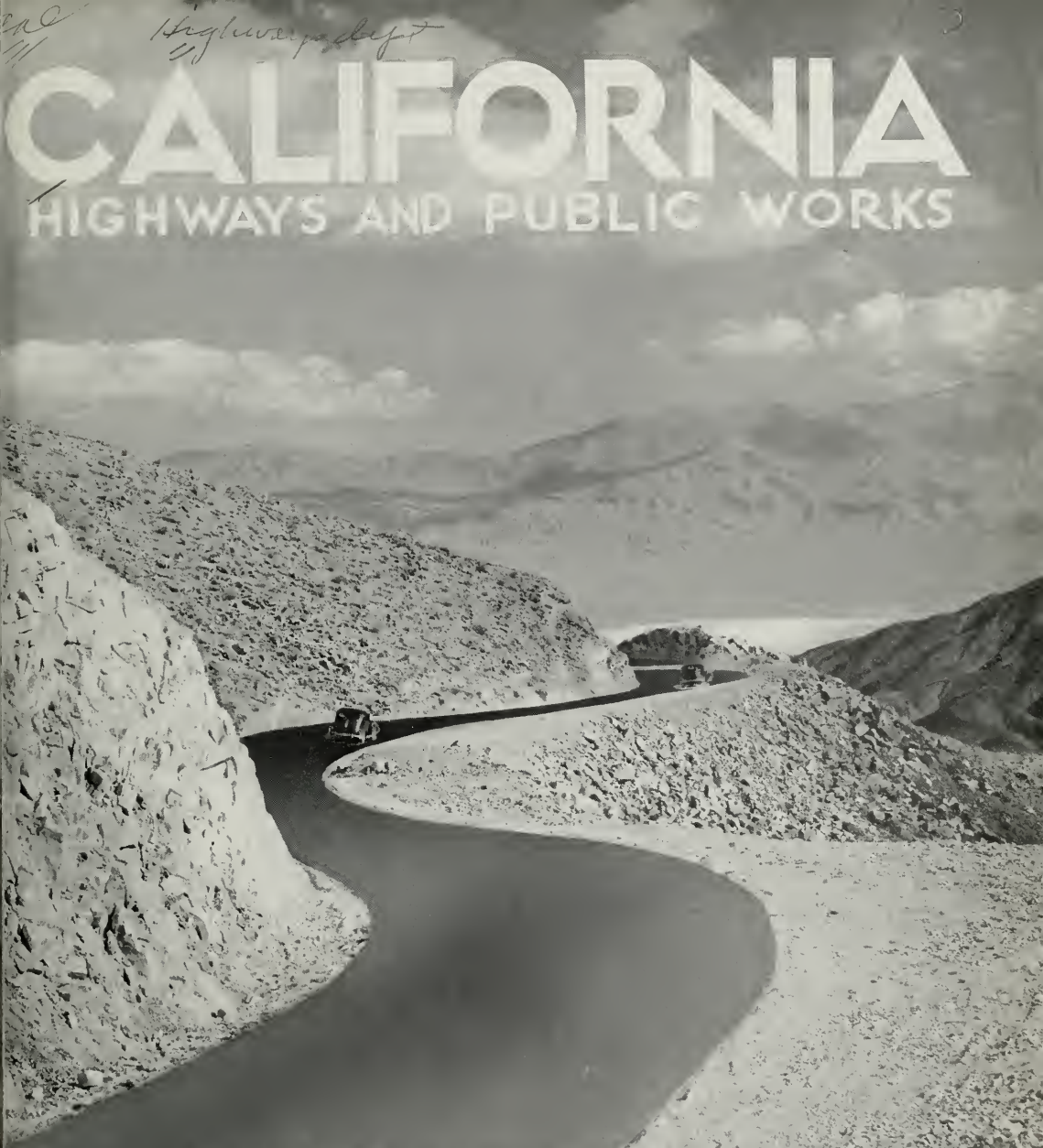
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New Link of Lone Pine-Death Valley Highway

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CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways of the Department of Public Works, State of California

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Various Types of Four-lane Separated Thoroughfares To Be Built During Biennium

New Divided Highway Plan

By FRED J. GRUMM, Engineer of Surveys and Plans

THE State Division of Highways is planning for immediate construction about 76 miles of four-lane divided highway which will supplement approximately 86 miles of this type of road now in use or under construction. This program includes a large portion of projects programmed for construction in the 1937-1938 biennium on the primary highways of the State.

The extent of this proposed type of construction is apparent when consideration is given to the possibility that the State highways, on which traffic volume will justify the divided type of highway construction, will approximate only about 5 per cent and will probably never exceed 10 per cent of the present State highway mileage.

INCREASED LANE WIDTHS ADOPTED

Incorporated in the design of the divided highways will be found the new standards of increased lane width recently adopted by the Division of Highways, which calls for a 12-foot width for the inside lane adjacent to the dividing strip, and an 11-foot width for the outside lane adjacent to the roadway shoulder. The 12-foot width for the inside lane will provide a greater operating space for vehicles while passing, thus reducing the possibility of sideswipe or the "overtaking" type of accident. The outer 11-foot width lane lies adjacent to a shoulder with width adequate for parking or for emergency movements. This shoulder will be surfaced or treated when conditions require such treatment.

The dividing strip will have a minimum width of 4 feet, the width in general being controlled by the best design which can be developed in adapting the existing pavement to the divided roadway type most economically and by the extent of the development of adjacent property directly affecting right of way costs.

DIVISION STRIPS TO BE PLANTED

For separation widths of 20 feet or less, curb construction is proposed with planting or landscaping, where climatic conditions or water supply permits and where heavy future maintenance will not be incurred. Trees and larger shrubs would probably only be planted in dividing strips greater than 20 feet in width.

In the narrow separation strips, where planting is not practical, the area between the curbs will receive a protective seal to prevent moisture penetrating to the subgrade and causing damage to the pavement. This method also often introduces a contrasting color scheme that definitely demarks the separation strip from the pavement.

The wider dividing strip offers several advantages over the minimum. As the width increases the driving hazard caused by opposing headlights is eliminated to a great extent. This hazard may be reduced further by the planting of low growing shrubs in the separating area. With a separation of 20 feet or more, protection to cross traffic is provided by an intermediate stop zone, between the two roadways.

Various types of separation strip construction have been given trial and consideration. The type apparently proving the most satisfactory in fulfilling the purpose for which



Embossed white arrows bordered by double traffic stripe make effective separation strip on four-lane highway.



Four-lane divided highway on coast route preserves existing tree rows in the separation strip.

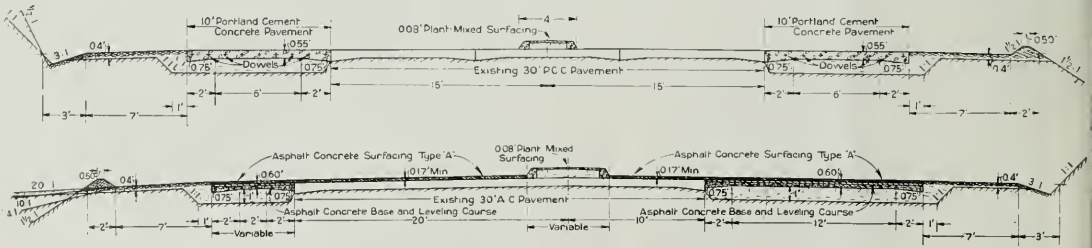
the dividing strip was designed, namely eliminating of opposing traffic hazard, consists of constructing curbs adjacent to the traffic lanes. The design of curb adopted on our work is 6 inches in height with a moderate sloping face. Studies of curb designs with light reflecting panels to increase visibility at night, are under way.

RAISED ARROWS EFFECTIVE

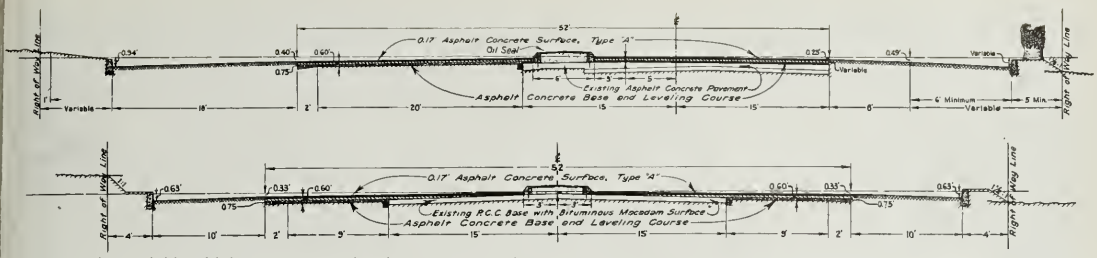
Another type of dividing strip, which is particularly effective through areas where local property developments would require so many openings in a central curbed island as to lose the effectiveness of the island construction, is the placing of embossed arrows diagonally across the separation strip with the raised arrow painted white and bordered by a double traffic stripe on each side. This design with distinctive marking sets out the dividing strip definitely from the pavement lanes. It is not, of course, as effective as the more positive curb construction but observation of traffic on installations of this type show that promiscuous crossing or invasion of the marked zone does not generally prevail and is rather carefully observed by the reasonably careful driver.

Separation of the roadway is accomplished by other means than the more conventional curbed design. Advantage is taken of the topography in some locations to use the existing 2-lane highway for one-way traffic and to construct another 2-lane, one-way traffic roadway adjacent thereto. This, in many cases, provides a separation by a differential in grades. In other instances the new roadway is planned to preserve the existing tree-rows by including them within the separation strip.

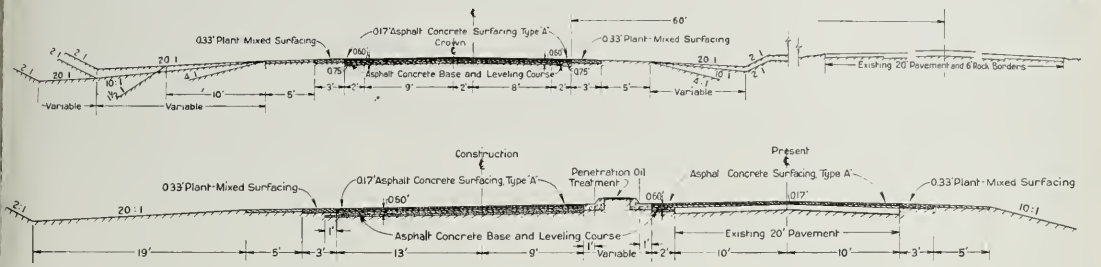
All roads requiring four lanes or more for adequate service to traffic will ultimately be developed into the divided type of roadway. There may be exceptions to this general



Design of four-lane divided highway proposed to be constructed in San Diego. Upper—Widening of Portland cement concrete pavement with curbed dividing strip. Lower—Widening of asphaltic concrete pavement with construction of curbed dividing strip.



Four-lane divided highway construction in San Bernardino County near Colton. Upper—Dividing strip off-centered in right of way with resurfacing of old pavement. Lower—Dividing strip centered upon existing pavement which is widened and resurfaced.



A 19.1 mile section of divided four-lane highway proposed for construction in Kern County, between one mile north of Grapevine and ten miles south of Bakersfield. Upper—A wide separation strip which will reduce the opposing light hazard and provide protection to cross traffic at intersections. Lower—Curbed dividing strip where right of way width is restricted and approaching transition to three-lane highway.



State highway approaching Long Beach; raised white arrows in center dividing strip.

design where large, long bridges or structures are involved or where urban development has reached such stages that the divided type of road would create a hazard or be a hindrance to the movement of traffic rather than an asset.

The adoption of the four-lane divided roadway design for highways which now are required to handle traffic exceeding two or three-lane capacity or which will ultimately de-



Type of four-lane divided highway used on route through Leucadia in San Diego County showing landscaping of center strip.

velop into that class, has also affected the design of our two and three-lane highways. On routes where future traffic increase will require a multi-lane road, the proposed two-lane or three-lane roadway is being so designed as to permit the development into a divided highway section with the least loss of existing values or investment.

Two-lane pavements, being constructed now and sufficient for present traffic, are being off-centered within the right of way, and sufficient right of way widths purchased to permit the ultimate construction without disturbing adjacent improvement when the need for the divided multi-lane roadway develops.

Three-lane pavements, whose capacity is estimated at double that of the two-lane, are being constructed as part of the program of progressive development affording both increased capacity, better service to traffic, and better economic adjustment to the funds available.

In other words, we are providing a better facility and relief from congestion by stage construction over longer mileage with limited funds which are insufficient to provide the ultimate improvement now.

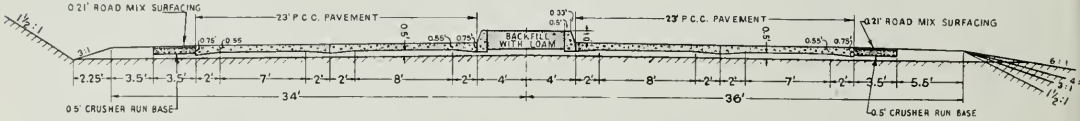
In the design of these three-lane pavements are incorporated features which make it readily adaptable to the divided multi-lane type, contemplating principally additional improvement and little or no revision occasioning loss of the first improvement. The parts of the 3-lane road which are to be converted or revised are of light and relatively cheap construction and even that has salvage value.

UNIT RECENTLY COMPLETED

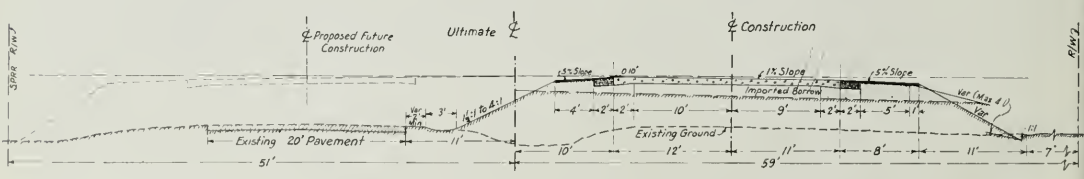
The 3-lane highway north of Fresno, recently constructed, is of this type. The two outside lanes are Portland cement concrete and the inner lane is of lighter intermediate material.

The outer permanent pavement lanes carry the bulk of the traffic load, the central lane is used primarily for passing purposes, and, therefore, less frequently and by the lighter, faster traffic units.

(Continued on page 20)



Divided four-lane approaches to the Redding Subway in Shasta County



Divided four-lane proposed in Merced County near Merced, existing highway used for one way traffic as a stage construction.



H. A. HOPKINS



H. R. JUDAH



R. S. REDINGTON

Highway Commission Personnel Changes

Assistant Director

MEMBER of the California Highway Commission since January, 1931, its chairman since 1932, Harry A. Hopkins of Taft, Kern County, advanced to a higher post in public service on October 15 when he was chosen by Director Earl Lee Kelly of the Department of Public Works to be assistant Public Works Director and received his appointment to that position from Governor Frank F. Merriam.

Elevation to his new office automatically made Mr. Hopkins a member of the California Toll Bridge Authority.

Graduating from high school in Los Angeles, Mr. Hopkins entered the oil business with which he has since been continuously connected. Taking up his residence in Taft in 1909, Mr. Hopkins helped incorporate that city in 1910, was a member of the first board of trustees there, serving for eight years, and then was elected mayor.

(Continued on page 25)

Becomes Chairman

DESCENDANT of a pioneer family of San Francisco, H. R. Judah, newspaper publisher and prominent citizen of Santa Cruz, member of the California Highway Commission since May, 1936, was on October 15 named by Governor Frank F. Merriam to be the commission's chairman, succeeding Harry A. Hopkins.

Born in Menlo Park, San Mateo County, Mr. Judah attended St. Matthews Military Academy for ten years and then entered the University of California, which he left after two years to associate himself with the home office of the Northern Commercial Company, then engaged in extensive commercial business on the Yukon River in Alaska.

In 1905, Mr. Judah went into the advertising business with his brother, F. S. Judah, and together they purchased the Peck and Garrett Company, which became the Peck-Judah Company, nationally known advertis-

(Continued on page 28)

New Member

CALLED into public service by Governor Frank F. Merriam, who appointed him a member of the California Highway Commission on October 15 to fill the vacancy created by the resignation of Harry A. Hopkins, Robert S. Redington of Los Angeles brings to his new post an enthusiasm for good roads that he has had for years.

A native of Los Angeles, Mr. Redington was educated in the public schools of that city and for the past ten years has been engaged in the mortgage and real estate business there. His work and a fondness for traveling have taken him into most of the various sections of the State affording him an opportunity to see and study the highway system of California. He has visited many states in the Union and toured Europe and the Orient always finding time to inquire into the latest highway construction methods here and abroad. Mr. Redington has been exceedingly

(Continued on page 20)



This photograph of Governor Merriam's official party was taken a few seconds before ribbon stretched across Lone Pine-Death Valley Highway was parted by bullet. Left to right, front row—Capt. C. Kane, C. C. C.; Wm. T. Hart, Highway Commissioner; Edward J. Neron, Deputy Director of Public Works; Gov. Merriam, Harry A. Hopkins, Assistant Director of Public Works; Father J. J. Crowley. Back row—Jess Hession, Deputy Attorney General; Earl S. Anderson, Registrar of Contractors; Fred E. Stewart, State Board of Equalization; Justus S. Craemer, Building and Loan Commissioner; Wm. A. Chalfont, Col. John White, U. S. National Park Service towering above Geo. Savage; Roy Boothe, U. S. Forest Supervisor.

NEW DEATH VALLEY HIGHWAY

CLIMAXING a three-day celebration featured by a pageantry of the past that never again will be staged in the West, Governor Frank F. Merriam on Sunday morning, October 31, officially dedicated the first major unit of the Lone Pine-Death Valley Highway, State Route 190, between Lone Pine and Death Valley in Inyo County.

Formal opening of the new desert road was signalized by a flash that came over telegraph wires from President Roosevelt in Hyde Park, New York, to a temporary receiving station set up beside the highway at its junction with the old Darwin Road, for years a terror to motorists owing to torrential summer cloudbursts and the tortuous Zinc Hill Grade.

Actual completion of the dedicatory ceremonies took place at Bad Water, 276 feet below sea level in Death Valley, where at sunset clear mountain water carried in a gourd from Lake Tulainyo, 12,865 feet up Mt. Whitney, was poured into the brackish slime of Bad Water while simultaneously signal fires flared up on peaks from Death Valley to Mt. Whitney.

California never has witnessed a more colorful, picturesque and unusual celebration than that which commemorated the opening of the Lone Pine-Death Valley Highway. Participating in the three-day fiesta were Paiute Indians; several descendants of survivors of the Jayhawker party of tragic memory, most of whose members died of thirst on the sun baked sands of Death Valley in December, 1849; a descendant of a survivor of the ill-fated Donner Party; pioneer desert stage drivers, cowmen, mule drivers, railroad men and prospectors, movie actors from Hollywood, state, county and city officials and a host of Inyo county citizens and their guests from near and far points.

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Scenes at dedication of Lone Pine-Death Valley Highway. Upper—View of new highway leading down into Panamint Sink. Center—Gov. Merriam, rifle in hand, rides as express messenger with Driver Ollie Dearborn on Mt. Whitney-Death Valley stage. Lower—Sam Ball, veteran desert prospector, hands gourd of water from Lake Tulainyo to Gov. Merriam while descendants of survivors of Jayhawker Party look on. Left to right—Henry and Frank Doty, sons of Capt. Ed Doty of Jayhawkers; Mrs. Melissa Lindner and E. W. Mecum, secretary of Jayhawker Association.

New Death Valley Highway

(Continued from page 6)

The celebration began at dawn on Friday morning when Jerry Emm, Paiute Indian runner, filled a gourd with water from Lake Tulainyo and started on an arduous trip down Mt. Whitney to Whitney Portal, fourteen miles distant. There, late in the afternoon, he turned the gourd over to a pony express rider, Bert Johnson, son of the first white man to climb to the heights of Mt. Whitney. Johnson raced with the gourd to Lone Pine, where the precious water receptacle was locked in a bank vault over night.

RELAYED BY PIONEERS' KIN

Early Saturday morning, the gourd was placed in the hands of Governor Merriam who turned it over to Sam Ball, a pioneer prospector who still is pursuing his desert search for gold. Ball strapped the gourd to the back of his burro and carried it through Lone Pine to an ox-drawn covered wagon that transported pioneers across the continent in '49. While Henry Doty of Buellton, his brother Frank Doty of Santa Barbara, sons of Capt. Ed. Doty of the Jayhawker Party, and E. W. Mecum, secretary of the Jayhawker Association, proudly looked on, young Sidney Doty, grandson of Capt. Doty, received the gourd from Sam Ball and handed it to Miss Josephine Breen of Hollister, descendant of a survivor of the Donner Party.

In the covered wagon, Miss Breen rode to a point several miles out of Lone Pine where Johnny O'Keefe, veteran mule skinner, awaited with his Twenty Mule Team, which he said never would be harnessed again. Miss Breen entrusted the gourd to O'Keefe, who took it several miles distant to where Ollie Dearborn, 76-year old driver of the ancient Mt. Whitney-Death Valley stage, was waiting with old Joel Hart, first stage driver to cross Death Valley, as a passenger.

GOVERNOR PLAYS GUARD

O'Keefe delivered the water to Dearborn, Governor Merriam climbed into the seat beside the driver, took over the rifle and the job of express messenger, and the stage was off at full speed to connect with a special train, the Slim Princess, consisting of a wheezy locomotive, time-worn baggage car and three dilapidated coaches, all of which have served the desert country since 1860.



Gov. Merriam draws bead on ribbon barrier, severing of which by bullet officially opened Lone Pine-Death Valley Highway.

The train was brought out of retirement for a final run in celebration of the occasion. With J. M. Henry, veteran engineer at the throttle, and Governor Merriam and his party and three carloads of invited guests in the coaches, the special made the run to Keeler, famous old mining town. Henry was custodian of the gourd during the trip. Jess Hession, Deputy Attorney General, who as a youth was a brakeman on the Slim Princess, donned a brakeman's cap and filled his former job while Fred Stewart, member of the State Board of Equalization, who is proud of the fact that he once was a section hand, gave his approval to the condition of the roadbed.

TRANSFERRED TO AUTO

The gourd remained overnight at Keeler. Early Sunday morning it was transferred to a streamline automobile and taken to the point of dedication, where Governor Merriam, Deputy Director of Public Works Edward J. Neron, representing Public Works Director Earl Lee Kelly; Col. John R. White of the National Park Service; Roy Boothe, U. S. Forest Service, and others spoke briefly.

By auto the water gourd was transported to Panamint Sink where it was flown over Telescope Peak to Furnace Creek in Death Valley, later being taken by air to Bad Water. Here was held the ceremony of the Wedding of Waters.

To Father John J. Crowley of Lone Pine goes the greatest measure of credit for the successful staging of the celebration. He and his committee worked for weeks arranging the details of the unusual pageant, and the rodeos, barbecues, parades and other events of the fiesta.

With the conclusion of these dedicatory ceremonies was signalized the formal opening of the first major unit of the Lone Pine-Death Valley highway which make more accessible two famous spots in Inyo County, Mt. Whitney, the tallest peak in the United States, and Bad Water in Death Valley, the lowest spot on the American continent.

The area traversed by this highway yearly attracts thousands of pleasure seekers from all points of the world, intrigued by the rugged Sierras, the desolate wastes of Death Valley and the romantic interest of Cerro Gordo, Darwin, Panamint City, Ballarat, Skidoo, Ryan, the old Borax Works, Stovepipe Wells and the famous Furnace Creek Ranch with its ultra modern successor, the Furnace Creek Inn.

With the completion of the valuable highway work now being undertaken within the confines of the Death Val-

ley National Monument by the National Park Service, and construction work by the State of Nevada adjacent to the Monument's easterly boundary, access will be afforded to the main north and south highway in the Nevada Highway system extending from Reno to Las Vegas.

When, in 1933, the Lone Pine-Death Valley route was made a secondary highway in the State system, it was narrow and crooked with steep grades, little more than a desert trail broken-in by the variegated traffic of emigrant trains, multi-teamed freighters, prospectors' burros, and occasional stages.

IDEAL WINTER CLIMATE

A territory that had been a living horror to El Dorado bound emigrants, by the very weirdness of its fantastic formation, drew prospectors to search its vast waste for mineral wealth, leading to the discovery of valuable deposits of lead, silver, soda, potash and borax. With the ever increasing number who penetrated this desert region came the realization that here was a land which, though summer temperatures soar to 140 degrees, is an ideal winter recreational area with mild, warm days and cool nights.

Recently developed resorts, such as Stove Pipe Wells, Furnace Creek Inn, and others, have attracted winter tourists in such numbers that, together with the need of mines and mills, improvement of roads into the region became a state-wide responsibility. As soon as possible after the highway from Lone Pine across the valley became a State route, the Division of Highways began widening and improving the old road with maintenance equipment until such time as major reconstruction could be started and a modern highway should replace the old trail.

EIGHT CONTRACT IMPROVEMENTS

In addition to the continual operations of the maintenance forces, the Division of Highways has performed work under eight contracts since the spring of 1934, amounting to about $140,000 and providing for shaping, oiling, and surfacing on nearly 150 miles of road to give better facilities to traffic.

Included in these contracts was the realignment of the road from 2 miles east of Lone Pine to 1 mile east of Owens River, with a new timber bridge across the river. This work provided for 1.7 miles of new road, graded 24 feet wide. Also in this program was the line change on the 2 miles between 8 miles southeast of Keeler and Centennial Wash, eliminating a hazardous stretch of one-way road; and the surface treatment of a total of 54 miles from the westerly edge of Panamint Sink to 3 miles west of the westerly boundary of Death Valley Monument and between Death Valley Junction and the San Bernardino County line.

Building for Highway Safety

Recent pronouncements of the State Division of Highways with regard to safety factors in highway building merit the hearty acclaim of California motorists. The policy of building highways so that they may more safely handle modern high-speed traffic has not only been declared, but is actually being put into effect. Center construction dividing the opposing streams of traffic on multiple-lane highways has been adopted for the new Altamont Pass highway. There are other notable instances of the kind. Further, the standard traffic lane width will henceforth be eleven feet instead of ten.— *Motorland.*

DANGEROUS GRADE ELIMINATED

The first major reconstruction planned by the State provided for elimination of that portion of the old road known as Zinc Hill Grade, which extended down Darwin Wash to the westerly edge of Panamint Sink. In 1934 reconnaissance surveys were begun in the high plateau country north of the town of Darwin. As the only trails in the jagged array of mountains in this territory were those made by burros and wild horses, leading nowhere, most of this survey was made on foot.

Reconnoitering the easterly portion of the plateau was comparatively simple but the greatest of difficulty was experienced in the selection of a suitable route descending the 2000 feet to the floor of Panamint Sink. To overcome this difference in elevation with a line of satisfactory gradient necessitated a curving alignment hanging to lava rims, dodging basalt cliffs, and skirting cinder cones, through the vari-colored grandeur of Rainbow Canyon to join the existing road at the mouth of Darwin Wash.

ARDUOUS ENGINEERING TASK

Staking in the preliminary line was found to be even a more arduous task than the reconnaissance. While the first six miles progressed rapidly, on much of the survey it was necessary to drive to the foot of the escarpment on the westerly edge of the sink and tortuously climb the 2000 feet to the rim carrying all the paraphernalia of a survey party, including the precious canteens of water.

But with all these difficulties it was possible to lay out a highway to be constructed to present day engineering standards and capable of carrying a large volume of modern traffic.

Between the connection with the old road northwest of Darwin and the junction at the mouth of Darwin Wash it was possible to reduce the distance from 20 miles to 17.6 miles and at the same time lay a maximum grade of 7.3% and a ruling grade down Rainbow Canyon of only 6.5% as against a maximum of 19%, with much over 15%, on the old road down Zinc Hill in Darwin Wash.

173 CURVES ABOLISHED

On the old road there were 245 curves, totaling over 12,000 degrees of curvature and with a minimum radius of 30 feet, while on the new road only 72 curves were necessary with total curvature of 4,100 degrees and a minimum radius held to 200 feet. Considerable portions of the old highway were one-way road but the new routing provides a 24-foot roadway.

The contract for construction of this new highway leading from the west to Death Valley was awarded to the Peninsula Paving Company on December 22, 1936, and on January 12, 1937, the first equipment was moved on to the job.

The estimated cost of the 17.6 miles of new road will be about $182,000. A contract for oiling this new section of highway was awarded on October 20, 1937, at the cost of $10,500.

"Your doctor's out here with a flat tire." "Diagnose the case as flatulency of the perimeter, and charge him accordingly," ordered the garage man. "That's the way he does."

Governor Merriam Dedicates El Cajon Divided Highway Unit

By E. E. WALLACE, District Engineer

FEATURED by one of the greatest civic celebrations in the city's history, a gala occasion highlighted by a parade in which 1500 persons participated and two dedicatory addresses by Governor Frank F. Merriam, San Diego's $600,000 El Cajon Boulevard was officially opened to traffic on Friday night, October 15.

El Cajon Boulevard is the entrance of the U. S. Transcontinental Route 80 into San Diego, which is its western terminus.

More than 40,000 persons lined the new thoroughfare from Texas Street to Euclid Avenue to witness the parade. Arriving at Texas Street and El Cajon Boulevard at 7.30, Governor Merriam, flanked by Vice Mayor Addison Housh, Director of Public Works Earl Lee Kelly and James Robbins, president of the El Cajon Boulevard Civic Association, cut a ribbon barrier stretched across the new highway and then pulled a switch which illuminated 70 ornamental lights along the three-mile stretch of the boulevard, and was the signal for the start of a roller skating race over the smooth pavement course.

The Governor then crowned Miss Katherine Hunter as queen of the celebration and with his official party led a two-hour parade at the conclusion of which final dedicatory ceremonies were held in the Hoover High School stadium.



While Director of Public Works Earl Lee Kelly, center, and James A. Robbins, president of El Cajon Boulevard Civic Association, right, look on, Governor Merriam pulls switch illuminating new El Cajon Boulevard in San Diego.



This picture was taken during excavation of unsuitable subgrade soil and abandoned pipe lines on El Cajon Boulevard.

In his address, the Governor said that El Cajon Boulevard indicated the trend in modern highway building toward separated highways which are highly beneficial to traffic and commendable because they decrease pedestrian hazards.

"I am happy to be here," the Governor said. "This is one of the best highways in the State of California. I am not saying that just to flatter you San Diegans—I am saying it because it is the truth. I bring to you the congratulations of the State. The city, county and federal governments must all be given their share of credit for their part in the project. I congratulate you on completion of a great civic undertaking."

Senator Ed Fletcher introduced the Governor. Other speakers were: Ad-

dison Housh, vice mayor; Walter Bellon, chairman of the board of supervisors; Milton Heller, acting president of the chamber of commerce; Charles Davis, president of the junior chamber of commerce; Capt. Paul Blackburn, commandant of the Naval Training Station; Maj. Gen. Louis Little, commanding the fleet marine corps; Maj. Gen. Harry Morehead, California National Guard Adjutant General; Harry A. Hopkins, retiring chairman of the California State Highway Commission, and newly appointed Assistant Director of the Department of Public Works, and Earl Lee Kelly, Director of Public Works of California.

El Cajon Boulevard was originally laid out with ample width, being 115 feet between curbs for a portion of its length. The progressive development of this boulevard had not previously allowed for the very poor adobe subsoil conditions encountered throughout its entire length, consequently the pavement was badly distorted.

During the preparation of plans for improvement, a thorough study of existing subgrade soils was made





These views of El Cajon Boulevard in San Diego graphically show the width of this new highway and the ornamental divided strip which also affords a safety zone for pedestrians.

at the district laboratory, resulting in the discovery that the shrinkage of the soil was more than three times the allowable limit and that the moisture content was as high as 20 per cent, caused partly by leaking water mains and by inadequate drainage.

The above conditions required correction before the repaving could be accomplished, and resulted in a rather expensive project. With the cooperation of city, federal and State authorities, approximately $340,000 was expended in providing proper drainage under and along three miles of El Cajon Boulevard, and removing the 12-inch water main from the center to the sides of the street.

After the drainage work was completed, a contract was awarded for the grading and paving project on the same three-mile section.

LARGE EXCAVATION JOB

The poor subgrade condition was corrected by removing 47,000 cubic yards of material from the central 50 feet of the road and replacing the subgrade soil with a selected disintegrated granite which had to be transported approximately three miles to the site.

Unfortunately, this work was in progress during one of the wettest winters encountered and this condition somewhat complicated our construction problems and added to the inconvenience of the adjacent property owners and business men. These people who were represented by the El Cajon Boulevard Civic Association overlooked many disagreeable and unavoidable conditions, and assisted the district forces in every way possible.

PROVIDES PEDESTRIAN ISLANDS

The final improvement provides a fine divided highway consisting of two one-way traffic lanes 22 feet wide on each side of, and separated by, a raised and curbed dividing strip 6 feet in width. Pedestrian islands are constructed on both sides of most of the street intersections, utilizing a white portland cement concrete. The islands are of sufficient height and width to provide a refuge for pedestrians and should assist in reducing the number of serious accidents which have occurred involving pedestrians attempting to cross the wide boulevard which has heretofore been inadequately lighted.

The city, county and State then cooperated in providing cable conduits, light standards and lights for each of the pedestrian islands.



Approximately $340,000 was spent in providing proper drainage under and along three miles of El Cajon Boulevard. This picture was taken during construction.

The grade of the new pavement was placed a little higher than the adjacent sides to provide for the resurfacing of the roadside adjacent to the new pavement and a bituminous premix was used to smooth out the irregularities and has, at least temporarily, provided a smooth surface adjacent to the new highway.

TRAFFIC GREATLY INCREASED

The paving project cost $312,000 and furnished 62,000 hours of employment to local labor and has resulted in a fine highway which has already greatly increased the traffic on this boulevard.

The final climax of this project was the elaborate and colorful opening which took place on the evening of October 15 when Governor Merriam dedicated the new boulevard and the Highway Commission participated in the parade and exercises which resulted from the carefully planned and whole-hearted cooperation of the El Cajon Boulevard Civic Association and the city authorities of San Diego.

Captain George T. Gunston Wins Promotion

In recognition of fifteen years of efficient service to the State, Captain George T. Gunston, Disbursing Officer of the Department of Public Works, on October 26 was promoted by Director of Public Works Earl Lee Kelly to the post of Administrative Assistant to Edward Hyatt, State Engineer and chief of the Division of Water Resources, succeeding the late John J. Haley, Jr.

Capt. Gunston entered the employ of the State on September 5, 1922, as Personnel Clerk and Assistant Secretary of the California Highway Commission. In July, 1923, he was appointed Disbursing Officer of the Department of Public Works, a position held until his elevation to his new job.

Born in Tacoma, Washington, Capt. Gunston gave up the idea of entering college when it appeared the United States would enter the World War and enlisted in the Washington National Guard in February, 1917. He was sworn into Federal service in June of that year and later attended Officers' Training School at Fortress Monroe, Virginia, where he earned a commission as second lieutenant.

Discharged from service in December, 1918, Capt. Gunston came to California and attended the University of California 1919-1920 and then transferred to the University of Washington. From 1923-1926, Mr. Gunston was second lieutenant, Finance Reserve. On June 14, 1926, he was commissioned first lieutenant, Field Artillery, California National Guard, and later was given command of Battery D, 143d Field Artillery.

Quarterly Gas Tax Distribution to Cities

THE third quarterly apportionment of the ¼-cent gasoline tax allocation under the Streets and Highways Code was distributed to the cities in October for expenditure only on streets of major importance.

A further apportionment of an equal amount will be made to the cities under Section 203 for expenditure on State highways within the cities to be expended under the supervision and control of the State Division of Highways. This money is not available to the cities until contracts have been entered into for the proposed work.

In accordance with the provisions of section 198 of the Streets and Highways Code, payment of the apportionment will be made to the cities to which expenditures have been delegated in the proportion of their pro rata share, and which have created a Special Gas Tax Street Improvement Fund to receive the payment. Payment to cities which have not submitted their annual budget will be deferred until the project statement has been received and the project agreement fully executed. The distribution for improvement of streets of major importance is as follows:

District I

City	Population	Amount
Del Norte County:		
Crescent City	1,720	$417.24
Humboldt County:		
Arcata	1,709	$414.58
Blue Lake	555	134.63
Eureka	15,752	3,821.19
Ferndale	889	215.66
Fortuna	1,239	300.56
Trinidad	107	25.96
Totals	20,251	$4,912.58
Lake County:		
Lakeport	1,318	$319.73
Mendocino County:		
Fort Bragg	3,022	$733.09
Point Arena	385	93.40
Ukiah	3,124	757.83
Willits	1,424	345.44
Totals	7,955	$1,929.76
Totals District I	31,244	$7,579.31

District II

City	Population	Amount
Lassen County:		
Susanville	1,358	$329.43
Modoc County:		
Alturas	2,338	$567.16
Shasta County:		
Redding	4,188	$1,015.94
Siskiyou County:		
Dorris	762	$184.85
Dunsmuir	2,610	633.14
Etna	379	91.94
Fort Jones	302	73.26
Montague	507	122.99
Mt. Shasta	1,009	244.77
Tulelake	300	72.78
Yreka	2,201	533.93
Totals	8,070	$1,957.66
Tehama County:		
Corning	1,377	$334.04
Red Bluff	3,517	853.17
Tehama	190	46.09
Totals	5,084	$1,233.30
Totals District II	21,038	$5,103.49

District III

City	Population	Amount
Butte County:		
Biggs	463	$112.32
Chico	7,961	1,931.21
Gridley	1,941	470.86
Oroville	3,698	897.08
Totals	14,063	$3,411.47
Colusa County:		
Colusa	2,116	$513.31
Williams	869	210.80
Totals	2,985	$724.11
El Dorado County:		
Placerville	2,367	$574.20
Glenn County:		
Orland	1,195	$289.89
Willows	2,024	490.99
Totals	3,219	$780.88
Nevada County:		
Grass Valley	3,817	$925.94
Nevada City	1,701	412.64
Totals	5,518	$1,338.58
Placer County:		
Auburn	2,661	$645.52
Colfax	912	221.24
Lincoln	2,094	507.97
Rocklin	724	175.63
Roseville	6,425	1,558.60
Totals	12,816	$3,108.96
Sacramento County:		
North Sacramento	2,097	$508.70
Sacramento	93,750	22,742.29
Totals	95,847	$23,250.99
Sierra County:		
Loyalton	837	$203.04
Sutter County:		
Yuba City	3,605	$874.52
Yolo County:		
Davis	1,243	$301.53
Winters	896	217.36
Woodland	5,569	1,350.95
Totals	7,708	$1,869.84

Quarterly Gas Tax Paid Cities to Improv

District III—Continued

City	Population	Amount
Yuba County:		
Marysville	5,763	$1,398.01
Wheatland	479	116.20
Totals	6,242	$1,514.21
Totals District III	155,207	$37,650.80

District IV

Alameda County:		
Alameda	35,033	$8,498.45
Albany	8,569	2,078.71
Berkeley	82,109	19,918.36
Emeryville	2,336	566.68
Hayward	5,530	1,341.49
Livermore	3,119	756.62
Oakland	284,063	68,909.25
Piedmont	9,333	2,264.04
Pleasanton	1,237	300.08
San Leandro	11,455	2,778.80
Totals	442,784	$107,412.49
Contra Costa County:		
Antioch	4,508	$1,093.57
Concord	1,125	272.91
El Cerrito	3,870	938.80
Hercules	392	95.09
Martinez	6,809	1,651.76
Pinole	781	189.46
Pittsburg	9,610	2,331.23
Richmond	20,189	4,897.54
Walnut Creek	1,014	245.98
Totals	48,298	$11,716.34
Marin County:		
Belvedere	500	$121.29
Corte Madera	1,027	249.13
Fairfax	2,925	709.56
Larkspur	1,241	301.05
Mill Valley	4,164	1,010.12
Ross	1,355	328.70
San Anselmo	4,650	1,128.02
San Rafael	8,022	1,946.01
Sausalito	3,667	889.56
Totals	27,551	$6,683.44
Napa County:		
Calistoga	1,000	$242.58
Napa	6,437	1,561.52
St. Helena	1,582	383.77
Totals	9,019	$2,187.87
San Francisco County:		
San Francisco	634,394	$153,894.09
San Mateo County:		
Atherton	1,324	$321.18
Bay Shore	1,149	278.73
Belmont	999	242.34
Burlingame	13,270	3,219.09
Daly City	8,435	2,046.20
Hillsborough	1,891	458.73
Lawndale	369	89.51
Menlo Park	2,254	546.79
Redwood City	8,962	2,174.04
San Bruno	3,610	875.73
San Carlos	1,132	274.61
San Mateo	13,456	3,264.22
South San Francisco	6,193	1,502.32
Totals	63,044	$15,293.49

District IV—Continued

City	Population	Amount
Santa Clara County:		
Alviso	381	$92.42
Gilroy	3,502	849.53
Los Gatos	3,168	768.51
Morgan Hill	908	220.27
Mountain View	3,308	802.47
Palo Alto	13,835	3,356.15
San Jose	62,022	15,045.57
Santa Clara	6,302	1,528.77
Sunnyvale	3,094	750.56
Totals	96,520	$23,414.25
Santa Cruz County:		
Santa Cruz	14,395	$3,492.01
Watsonville	8,641	2,096.17
Totals	23,036	$5,588.18
Sonoma County:		
Cloverdale	759	$184.12
Healdsburg	2,296	556.97
Petaluma	8,245	2,000.11
Santa Rosa	10,636	2,580.13
Sebastopol	1,762	427.44
Sonoma	980	237.73
Totals	24,678	$5,986.50
Totals District IV	1,369,324	$332,176.65

District V

Monterey County:		
Carmel	2,260	$548.24
King City	1,483	359.75
Monterey	9,141	2,217.46
Pacific Grove	5,558	1,348.29
Salinas	10,464	2,538.40
Soledad	594	144.10
Totals	29,500	$7,156.24
San Benito County:		
Hollister	3,757	$911.39
San Juan Bautista	772	187.28
Totals	4,529	$1,098.67
San Luis Obispo County:		
Arroyo Grande	892	$216.38
Paso Robles	2,573	624.17
San Luis Obispo	8,276	2,007.63
Totals	11,741	$2,848.18
Santa Barbara County:		
Lompoc	2,845	$690.15
Santa Barbara	33,613	8,153.99
Santa Maria	7,057	1,711.92
Totals	43,515	$10,556.06
Totals District V	89,285	$21,659.15

District VI

Fresno County:		
Coalinga	2,851	$691.61
Clovis	1,316	319.24
Firebaugh	506	122.75
Fowler	1,171	284.07
Fresno	52,876	12,826.89
Kingsburg	1,322	320.70
Parlier	564	136.82
Reedley	2,589	628.05
Sanger	2,967	719.75

Major Streets Other Than State Highways

District VI—Continued

City	Population	Amount
San Joaquin	163	$39.54
Selma	3,047	739.15
Totals	69,372	$16,828.57
Kern County:		
Bakersfield	26,015	$6,310.83
Delano	2,632	638.48
Maricopa	1,071	259.81
Taft	3,442	834.98
Tehachapi	736	178.54
Totals	33,896	$8,222.64
Kings County:		
Corcoran	1,768	$428.89
Hanford	7,028	1,704.88
Lemoore	1,399	339.38
Totals	10,195	$2,473.15
Madera County:		
Chowchilla	847	$205.47
Madera	4,665	1,131.65
Totals	5,512	$1,337.12
Tulare County:		
Dinuba	2,968	$719.99
Exeter	2,685	651.34
Lindsay	3,878	940.74
Porterville	5,303	1,286.43
Tulare	6,207	1,505.72
Visalia	7,263	1,761.89
Totals	28,304	$6,866.11
Totals District VI	147,279	$45,727.59

District VII

Los Angeles County:		
Alhambra	29,472	$7,149.45
Arcadia	5,216	1,265.32
Avalon	1,897	460.18
Azusa	4,808	1,166.35
Bell	7,884	1,912.54
Beverly Hills	17,429	4,228.00
Burbank	16,662	4,041.94
Compton	12,516	3,036.19
Covina	2,774	672.93
Culver City	5,669	1,375.21
Claremont	2,719	659.59
El Monte	3,479	843.95
El Segundo	3,503	849.77
Gardena	7,044	1,708.76
Glendale	62,736	15,218.77
Glendora	2,761	669.78
Hawthorne	6,596	1,600.09
Hermosa Beach	4,796	1,163.43
Huntington Park	24,591	5,965.39
Inglewood	21,421	5,196.40
La Verne	2,860	693.79
Long Beach	142,551	34,580.65
Los Angeles	1,240,575	300,944.15
Lynwood	7,323	1,776.44
Manhattan Beach	1,891	458.73
Maywood	6,794	1,648.12
Monrovia	10,890	2,641.74
Montebello	5,498	1,333.73
Monterey Park	6,406	1,554.00
Pasadena	76,362	18,524.23
Pomona	20,804	5,046.73
Redondo Beach	9,347	2,267.44
San Fernando	7,567	1,835.64
San Gabriel	7,299	1,770.62

District VII—Continued

City	Population	Amount
San Marino	3,730	$904.84
Santa Monica	37,146	9,011.04
Sierra Madre	3,550	861.17
Signal Hill	2,932	711.26
South Gate	19,632	4,762.42
South Pasadena	13,730	3,330.68
Torrance	8,834	2,142.99
Vernon	1,269	307.84
West Covina	919	222.93
Whittier	14,846	3,601.41
Totals	1,896,728	$460,116.63
Orange County:		
Anaheim	11,013	$2,671.58
Brea	2,435	590.69
Fullerton	10,860	2,634.47
Huntington Beach	3,690	895.14
Laguna Beach	1,981	480.56
La Habra	2,273	551.40
Newport Beach	2,203	534.41
Orange	8,066	1,956.69
Placentia	1,606	389.59
San Clemente	667	161.80
Santa Ana	30,322	7,355.64
Seal Beach	1,156	280.43
Tustin	926	224.63
Totals	77,198	$18,727.03
Ventura County:		
Fillmore	2,893	$701.80
Ojai	1,468	356.11
Oxnard	6,285	1,524.64
Santa Paula	7,452	1,807.74
Ventura	11,603	2,814.71
Totals	29,701	$7,205.00
Totals District VII	2,003,627	$486,048.66

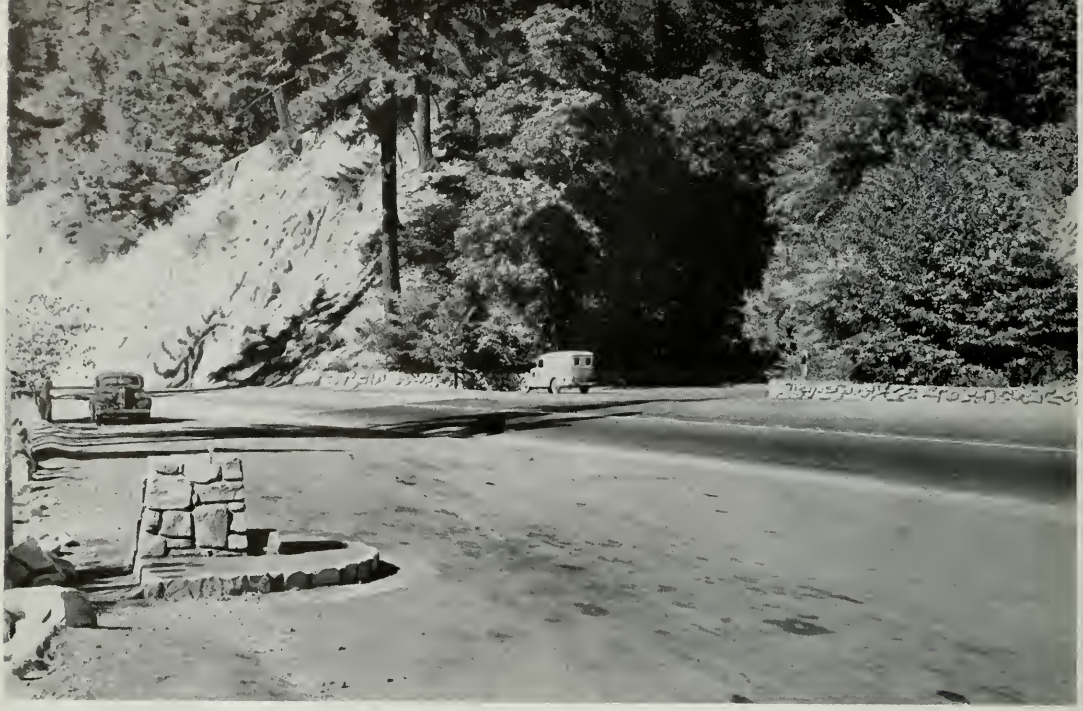
District VIII

Riverside County:		
Banning	2,767	$671.23
Beaumont	1,332	323.12
Corona	7,018	1,702.46
Elsinore	1,350	327.49
Hemet	2,235	542.17
Perris	763	185.09
Riverside	29,696	7,203.79
San Jacinto	1,346	326.52
Totals	46,507	$11,281.87
San Bernardino County:		
Chino	3,118	$756.38
Colton	8,014	1,944.07
Needles	3,144	762.69
Ontario	13,583	3,295.02
Redlands	14,177	3,439.12
Rialto	1,642	398.32
San Bernardino	39,068	9,477.29
Upland	4,713	1,143.30
Totals	87,459	$21,216.19
Totals District VIII	133,966	$32,498.06

District IX

Inyo County:		
Bishop	1,159	$281.15

(Continued on page 28)



This picture shows one of the many attractive mountain parkways provided for the use of motorists interested in viewing scenic attractions on California highways. Here is shown the Mormon Slide Parkway in San Bernardino Mountains. Drinking fountain in foreground.

Parking Areas on Mountain Highway

By B. A. SWITZER, Assistant Highway Engineer

THE first section of "High Gear" road into the San Bernardino Mountains was completed in 1929. An almost unbelievable development of mountain forest recreational use followed with a consequent increase in motor traffic.

The U. S. Forest Service, has conducted a traffic study in connection with the development of the San Bernardino National Forest and estimates that 1,239,000 people visit this mountain district over this road annually. Of this number it is estimated that approximately three-quarters of a million people make the trip for the sole purpose of enjoying the scenery.

This large increase of traffic created a demand for appropriate roadside improvement and beautification and many problems arose that had to be solved.

Erosion from the long slopes caused by the construction of the road across the precipitous face of the mountains had to be controlled.

Motorists interested in viewing the ever-changing scenery had to be served with places where they could safely stop to enjoy the views.

Drivers, having difficulty with cars due to inexperience in mountain driving, or defective mechanism, created a need for parking areas.

Extra width or the use of guard rails were found necessary to give protection to the motorist.

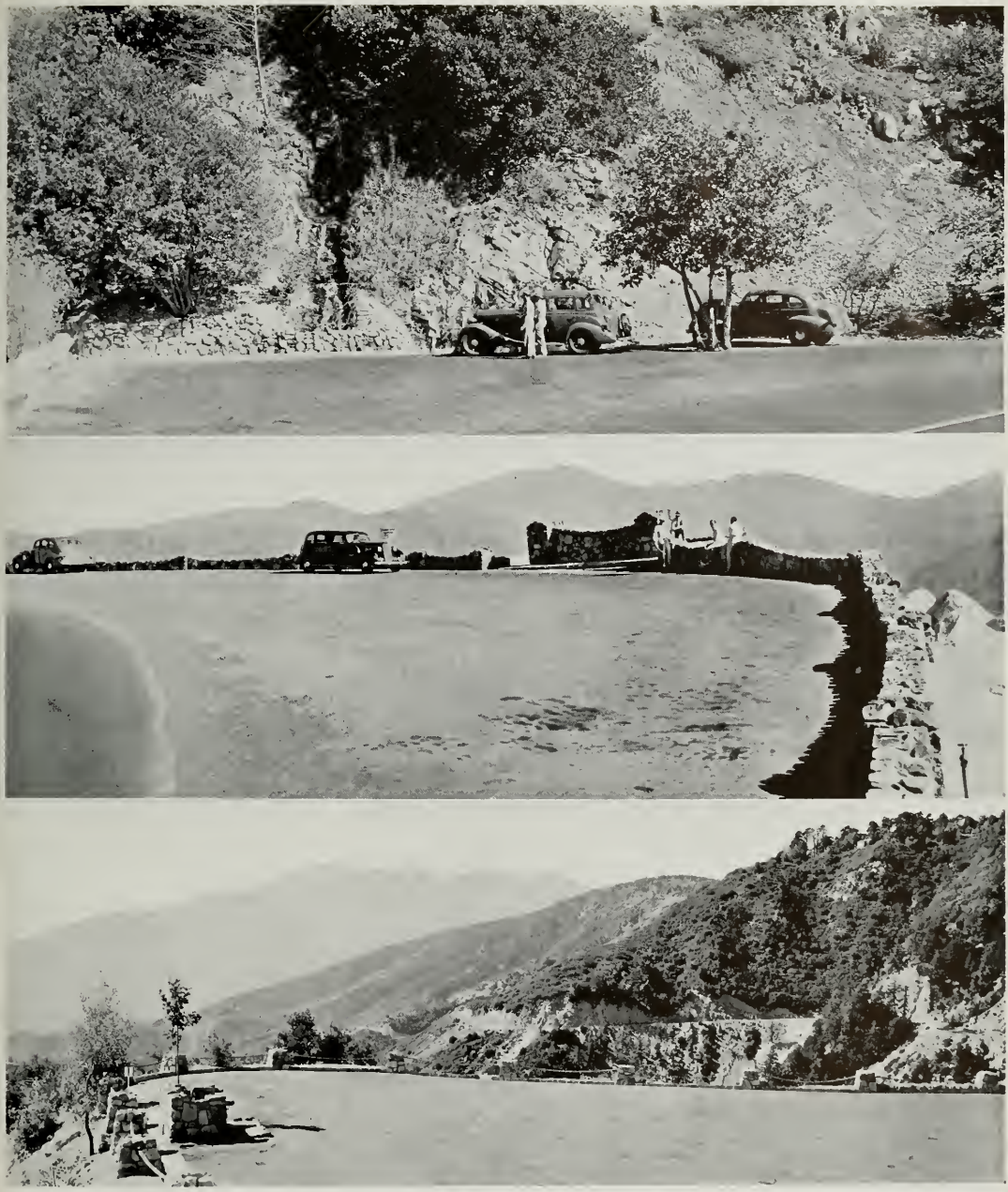
FILL SLOPES PLANTED

Erosion on the slopes is being taken care of through vegetative erosion control consisting of the placing of wattles across the raw fill slopes and the planting of hardy shrubs and trees which will serve to restore the slopes to their original condition and to obscure the rough cut slopes above the roadway.

The motorist interested in the scenery or out for an afternoon drive finds parking places constructed at lookout points, and sheltered coves where he may park his car off the traveled way and enjoy the magnificent views of the valleys below or the cooling shade of the forest foliage.

For the inexperienced driver or the unfortunate motorist having trouble with a defective car, wide parking areas are provided and drinking fountains have been constructed, mak-

(Continued on page 21)



Views of mountain parkways typical of those constructed by the Division of Highways on State Route 43, the "high gear" road into the San Bernardino Mountains. Upper—One of most popular of all parkways. There are two fountains, a waterfall and shade trees. Center—Strawberry Parkway Lookout. From this point practically the entire San Bernardino Valley may be seen. Lower—Valley View Point looking westerly toward Cajon Pass.

Six Grade Crossings Are Done Away With By Niles Project

By W. J. DEADY, Resident Engineer

THE recently completed project through Niles which involved the relocation of approximately three miles of highway included the construction of six grade separation structures and a new reinforced concrete bridge across Alameda Creek. The project is outstanding because of the many structures which were concentrated in such a limited area.

The town of Niles, located about twenty miles south of Oakland is the junction point of the Southern Pacific and Western Pacific tracks where their branch lines intersect the main line tracks from Oakland and San Francisco to points east. It is also the focal point of highway traffic where the east and west highways from Niles Canyon, Newark and Centerville intersect the primary State highway leading from Oakland and the East Bay Metropolitan area to points south.

Six grade crossings were eliminated, one obsolete underpass with impaired vertical and horizontal clearance was reconstructed and one narrow underpass was converted into a four lane divided subway. Through traffic has been transferred from the congested business district of Niles to a new improved and unobstructed alignment of ample width to handle present day traffic requirements with safety.

The designs of the underpasses are of three distinct types. The largest structure on the Niles Branch of the Southern Pacific Railroad consists of two cellular U type abutments, supporting two main line tracks and the abutments will provide support for a future wye track.

The second in size on the Western Pacific main line also has the cellular U type abutments which support two railroad tracks. Both of these underpasses have a roadway width of 44 feet with a 5 foot sidewalk on each side to accommodate pedestrian traffic.

The subway under the tracks of the Western Pacific Railroad differs from the one under the Southern Pacific tracks in that the bottom of its depressed portion is below high water of the nearby Alameda Creek and is designed with a thick pavement slab and is adequately waterproofed to withstand the hydrostatic pressure from below the pavement slab. It is equipped with a unit of two five inch automatic electric pumps. The surface water which collects in the Southern Pacific Subway is drained by a gravity septem into Alameda Creek and does not require pumps to drain the depressed portion of the roadway.

The subway under the Western Pacific San Jose Branch, a former two lane underpass which supported one railroad track was converted into a four lane subway with twin openings. The depressed portion provides a dividing island which separates the traffic coming from opposite directions. It consists of two twenty-two foot roadways and one five foot sidewalk. The old portion of the structure was architecturally treated so as to blend with the new work.

THREE UNDERPASSES

The three underpasses on the secondary highways, two of which are on the Centerville connection and one on the Niles Canyon road, which replaced the antiquated structure, are all provided with a twenty-two foot roadway and two five-foot open sidewalks.

These subways are designed in such a manner, with the sidewalks placed between the abutment walls, that the roadway width can be increased to provide an additional traffic lane at very little cost, at such time as the volume of traffic will warrant the additional width.

In addition to the six underpass structures, the project also included a new bridge over Alameda Creek. This structure is of the rigid frame, arch girder type with fluted piers. It is four hundred and thirty feet in length and has a roadway width of forty-four feet with two five-foot sidewalks. This type of bridge was chosen because of its particular suitability to the site as well as its pleasing appearance. The footings are supported by steel H beam piles forty feet in length which penetrate through the gravel in the stream bed.

In connection with the construction of the new bridge the project included the demolition of the old bridge across Alameda Creek. The old bridge was of the multiple arch type constructed many years ago by Alameda County. A major portion of the broken concrete from this structure was used in the construction of submerged protection work around the southeast approach of the new bridge.

ROADBED 56 FEET WIDE

The roadbed throughout the length of the new work on the main highway is fifty-six feet wide and is surfaced with bituminous treated stone screenings to a width of 31 feet, with the exception of the depressed portion of the three subways which are paved with Portland cement concrete pavement. The shoulders are treated with a liquid asphalt penetration treatment. The roadway is designed so that when the volume of traffic demands, it can readily be resurfaced with four lanes of pavement throughout its length.

The roadbed of the secondary connecting roads are 36 feet in width with a 22-foot width of surfacing consisting of bituminous treated stone screenings and shoulders treated with liquid asphalt.

VAST AMOUNT OF MATERIALS

Materials used in the work included 20,000 tons of concrete aggregate, 12,000 tons of gravel, 18,500 barrels of cement, 670 tons of structural steel, 5800 lineal feet of steel piles,



This unit of the Niles grade separation project is the Edenvale Underpass under tracks of Western Pacific Railroad.



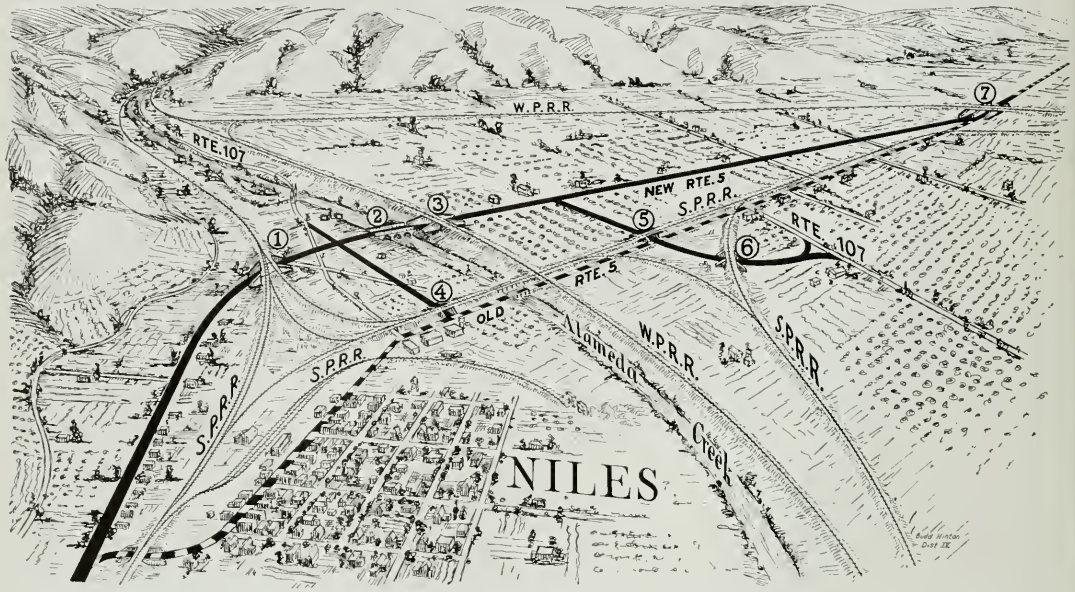
View of four-lane bridge across Alameda Creek, one of units of the Niles improvement undertaking recently completed.



North Nile Underpass under railroad tracks of the Southern Pacific Company at Niles.

1100 feet of treated Douglas fir piles, 890 tons of liquid asphalt, and 21,000 lineal feet of various kinds of pipes over 6 inches in diameter. The contractor's records show that approximately 171,000 man-hours were worked directly on the project. This does not include the employment of railroad employees or labor engaged away from the site necessary to provide the needed materials. The contract was executed by Eaton and Smith of San Francisco.

The improvement was financed for the most part from funds made available by the Federal Government from Works Progress Administration funds under the Emergency Unemployment Relief Act of 1935. The total cost of the project was approximately $650,000 of which the State contributed an amount of approximately $122,000.



This sketch map shows details of the Niles grade separation and relocation project as follows: 1—Southern Pacific main line underpass for relocated Route 5 indicated by heavy black line. 2—Concrete bridge over Alameda Creek. 3—Western Pacific main line underpass. 4—Southern Pacific-San Jose branch underpass for Niles Canyon road. 5-6—Underpasses beneath Southern Pacific for State Highway 107 connection to Centerville. 7—Underpass of Western Pacific branch to San Jose. Dotted line shows present State Highway Route 5.

R. S. Redington, Member of Highway Commission

(Continued from page 5)

active in civic and fraternal affairs in Los Angeles. He was Exalted Ruler of the Elks in the southern city last year and a member of the 1936 Los Angeles Grand Jury.

Yatching is Mr. Redington's favorite recreation. He is a member of the Catalina Yacht Club and the Long Beach Yacht Club.

The new Highway Commissioner is a Scottish Rite Mason, member of Al Malaikah Temple of the Shrine and Ramona Parlor of Native Sons and a member of the Los Angeles Athletic Club and numerous other clubs and associations.

Various Types of Four-lane Thoroughfares

(Continued from page 4)

It presents further economic advantages. It is more flexible and adaptable to future expansion into a divided multi-lane road without loss of design continuity or of capital investment.

The center lane, of the cheaper and lighter type of surfacing, can be easily scarified, broken up and salvaged for use as shoulder material when the road is expanded to the 4-lane divided section and this center lane then becomes the separation strip while the two pavement lanes become the inside lanes of the 4-lane divided road.

The contrast in color between the two outside lighter colored lanes and the darker inner lane have produced another advantage. The contrasting color, texture and character of the pavement surfaces, although of equal smoothness and rideability, seem to act psychologically as a barrier to an indiscriminate use of the center lane for other than passing purposes, nor do vehicles in the outer lane crowd across the inner edge of their lane.

SIDE-ROAD DESIGN POSSIBLE

The divided highway is not confined to the single division strip type which separates traffic moving in opposite direction. The single division

strip type of road offers protection against the hazards of opposing traffic—the "approaching" type of accident or head-on collision. Widened pavement lanes providing greater room for movement will help to reduce the "overtaking" type of accident—side-swiping and rear end collision. On our heavy traffic roads, however, additional protection or facility is necessary to further reduce these hazards and particularly to prevent congestion—to provide for continuous, free, comfortable flow of traffic.

A segregation or separation of the different kinds of traffic—local and through—will largely accomplish this purpose. By carrying our design further, by employing several divisions of the roadway, such a separation can be achieved. Such a design includes side-roads, to serve the abutting property and local traffic, on each side of and separated from the central divided roadway which carries the through traffic. It is actually a triple highway.

Our highways entering the urban areas surrounding the larger centers of population are particularly subject to congestion produced by traffic patronizing business developed along these arteries.

QUESTIONABLE DEVELOPMENT

Expansion of these roads by the simple expedient of adding more lanes of pavement does not increase their capacity, at least not for long. More traffic, attracted by the wider road, seems only to invite more development of abutting property. Whether such development is profitable as a whole is questionable. It is certainly not profitable to the motorist who foots the bill for the road improvement.

The triple roadway section is one means of preventing the recurring problem of congestion and attendant hazards. The difficulty presented by the necessity for wide right of way and consequently large cost through well developed property, usually encountered in such urban areas, may limit its use to some extent. Study of the situation, however, indicates that other means of protecting the highway against congestion are usually equally costly in these locations.

A short section of this type of highway is now under construction through Montecito adjacent to Santa Barbara. Ultimate improvement to this type of other highways through urban areas is planned.

These higher standards of highway design and construction such as the wider pavement lanes and divided roadways naturally lead to inclusion of other features that supplement the first named, more important ones.

SAFETY FEATURES PROVIDED

Bridge and structure widths will be increased to provide a minimum roadway width 4 feet greater than the width of pavement lanes of the approaching roadway. The division strip will be carried through the structure wherever economically reasonable and possible.

Important highway intersections, where traffic conditions do not now justify the construction of grade separations, will be protected by traffic islands and segregation lanes with installation of lights and proper directional signs.

Parking Areas on Mountain Highway

(Continued from page 16)

ing water available for both man and radiator.

A WATERFALL CREATED

In one case, a mountain spring has been diverted and now drops over a precipitous cliff adjacent to the highway forming an artificial waterfall which is tremendously enjoyed by everyone passing.

One of the most important problems on mountain highways is the development of safety. On this road an answer to this problem has been found in the construction of stone piers and heavy chains which mark the edge of the highway and protect the motorist from plunging to the deep ravines below.

The piers of this "rock and chain" protection are constructed on a heavy foundation base extending three feet below the surface of the road and the whole pier is built about a four inch heavy steel pipe to which the eye bolts holding the chain are attached. The chain used between the piers is five-eighths inch galvanized iron chain with a breaking strength of over 20 tons.

Traffic on Bay Bridge 33,000 Up in October

AN INCREASE last month in practically every classification of vehicle on the San Francisco-Oakland Bay Bridge was announced by State Director of Public Works Earl Lee Kelly from the October traffic report filed by State Highway Engineer C. H. Purcell.

Total number of vehicles crossing the span during the month of October was 738,868 compared with 705,704 during the month of September, an increase of 33,000. This brings the total number of vehicles to cross the bridge, as of November 1, to 9,022,099.

Five Sundays, a 31-day month, and football, were factors Director Kelly attributed to the increase.

Average number of cars per day was 23,834 with September's average 23,523. Total collections for October were $393,465.25—up $16,000 from the previous month's business of $377,344.65.

31,000 MORE AUTOS

Passenger automobiles showed an increase of more than thirty-one thousand during October, with a total of 695,079 compared with 663,520 for September.

There was an increase of two thousand in the number of trucks crossing the bridge for the month, with 27,145 for October; and 25,993 for September.

A gain of approximately one thousand in the number of buses crossing the structure for October was also reported; with 10,453 buses for that month, as compared to 9,462 in September.

Comparative figures follow:

	Passenger autos	Auto trailers	Motor cycles
Total Sept.	663,520	1,689	2,994
Total Oct.	695,079	1,337	2,729
Total since opening	8,589,620	15,706	32,020

	Tricars	Trucks
Total Sept.	772	25,993
Total Oct.	836	27,145
Total since opening	7,212	274,951

	Truck trailers	Buses	Total vehicles
Total Sept.	1,274	9,462	705,704
Total Oct.	1 299	10,453	738,868
Total since opening	20,270	82,320	9,022,099

	Extra passengers	Freight pounds
Total Sept.	173,144	64 446,664
Total Oct.	184,416	69 243,169
Total since opening	1,857,420	626,072,682

Los Gatos-Santa Cruz Highway Modernization Nears Completion

By H. R. JUDAH, Chairman, California Highway Commission

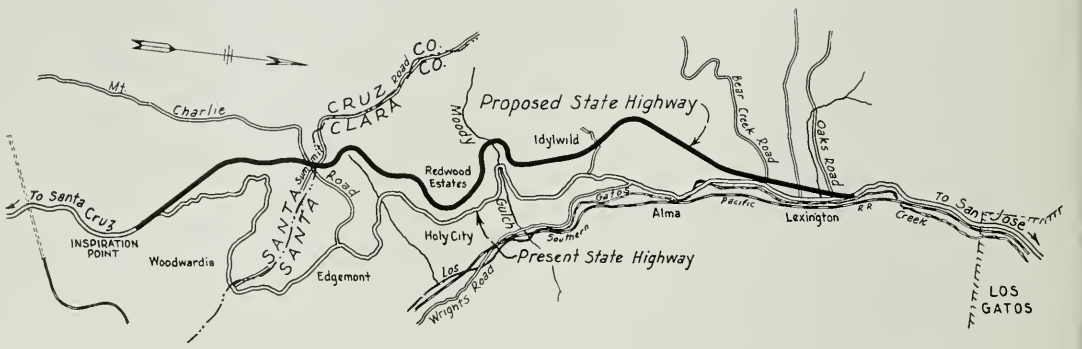
MOTORISTS from every part of California will hail with delight the announcement made early this month by the State Highway Department that it will start asking for bids on approximately six and one-half miles of new highway running northerly from Inspiration Point in Santa Cruz County to what is known as the Oaks Road in Santa Clara County in the Los Gatos Canyon, the northern terminus of the job being a mile and five-eighths southerly of Los Gatos.

This improvement when completed will be one of the most important highway undertakings in the history of the Department and will modernize to the last degree the largest portion of the well known and well traveled recreational highway which leads from Los Gatos southerly into the popular Santa Cruz recreation area, the San Lorenzo Valley, and all of the important resort sections along the northern shore of Monterey Bay.

improvement in order to wipe out once and for all the dangerous and uncomfortable travel over the 16-foot circuitous road that now exists between Inspiration Point and Los Gatos.

The forthcoming job will mean a new grade completely, at no point touching the present road. This has a decided importance for the reason that the Los Gatos-Santa Cruz lateral of the State highway system is the main northern entry into the Santa Cruz recreational area and the disadvantages that would accrue from trying to detour traffic on a rebuilding job on the present road are obvious.

The original Los Gatos-Santa Cruz lateral of the State highway system was one of the "county seat" laterals that were provided in the State bond issue of 1911, a stipulation of that issue requiring that every county seat in the State should be linked with the chosen main arteries.



TWO CONTRACTS COMPLETED

Previously the State Highway Department in two contracts has modernized this important highway from the city of Santa Cruz to Inspiration Point. There remains from this point the completion of this newest

HEAVY TRAFFIC INCREASE

During the interim between 1912 and the present, the popularity of the Big Basin country in Santa Cruz County and the resort areas of the Monterey Bay region has brought about a continually increasing traffic over the narrow winding highway that was originally constructed. Even within the past few years, there have been Sunday afternoons when returning traffic from the Santa Cruz area would back up as far as five miles southerly from Los Gatos unable to move, due mainly to the inadequacy of the road.

Traffic counts taken at Los Gatos for sixteen-hour periods in July have shown figures as high as 14,000 cars. Research by the Santa Cruz Chamber of Commerce had developed the fact that many persons of a timid nature have in recent years foresworn the use of the Los Gatos-Santa Cruz highway because of its hazards.

SCENERY ATTRACTS

The completion of the Los Gatos-Santa Cruz highway through the medium of this new improvement will have a state-wide significance. Many motorists from every county in California as well as thousands of visitors from most of the States of the Union and a smattering of foreign cars, have regularly patronized this road in the last twenty-five years. The wonder has been at the patience shown by the average motorist in making the slow trip over the Santa

Cruz mountains to the shores of Monterey Bay, except that some compensation has come from the appreciation of the magnificent scenery afforded on this route.

The terrain through which the new 6½ mile four-lane highway will pass is mountainous and generally wooded. A considerable portion of the surrounding land is subdivided and partly developed, with many cabins, cottages and occasional pretentious homes and estates.

CONSTRUCTION PROBLEMS

A difficult problem was presented in selecting the best routing for the new stretch of highway, not only in establishing acceptable grades and alignment in developing within a limited distance a descent from summit to the canyon floor before reaching Los Gatos, but also in designing the roadway through large cuts and over deep ravines, where the character of soil and the presence of underlying water indicated probable instability.

The proposed location is much more direct than the existing highway and, in general, follows parallel to it but at higher elevations. Before determining the adopted location for the new improvement, four alternative lines were investigated, some running at higher elevations and others closer to the present grade. The upper location finally chosen was the best that could be discovered for a stable road condition through a region that contains the San Andreas fault and is structually broken.

NEW ROAD 46 FEET WIDE

The new roadway will have a surfaced width of 46 feet and will require the excavation of about 2,300,000 cubic yards. Large cuts and high fills are necessary and in several places the minimum curvature standard of 500-feet radius was employed in order to avoid carving so deeply or filling so excessively through this fractured formation that there would be grave doubts that slopes would stand as constructed.

An original intention to run the highway over a structure at Moody Gulch was abandoned on account of its length, entailing an expenditure of one-half million dollars and the doubtful character of the foundation for the bridge footings on the south side.

Plans on the new construction include separate connections to the road used as the Skyline Boulevard, State Route 55. These plans also provide for the future ultimate treatment, when the Skyline Boulevard is permanently located. Several sites that will later be developed as landscaping projects, for public use have been selected and acquired for parking areas.

The following table illustrates the benefits that the proposed construction will effect:

	Existing	Proposed
Length	8.21 mi.	6.25 mi.
Number of Curves	132	20
Total Curvature	7700 degrees	1118 degrees
Minimum Radius of Curves	75 feet	500 feet
Maximum Grade	6%	7% (in stretches)
Average surface width	20 feet	46 feet

It is of interest to note that forty of the 132 curves on the existing road have a radius of 100 ft. or less, whereas the minimum radius of curvature on the new location applies to only several curves.

SAVING OF TWO MILES

The maximum grade on the proposed location uses in some stretches a higher rate of grade than the general gradient that is used on the old road. The maximum grade was necessary in order to meet definite controls and to obtain a more direct routing.

The new road will be approximately two miles shorter than the existing highway and contains only about one-seventh the amount of central angle of curvature. Reference to the sketch map of the project will indicate the improvement in this respect.

The reduction in distance, as reflected in the saving in operation of vehicles and based on the average travel now using the existing road, represents a capitalized value of about $850,000. This is a value equal to about two-thirds of the entire cost of the new construction and in itself shows the proposed work to be a sound business undertaking.

In Memoriam

Thomas S. O'Connell

The American engineering profession sustained a distinct loss with the passing on November 3 of Thomas Sarsfield O'Connell, State Highway Engineer of Arizona, who was a native son of California. Mr. O'Connell's death was sudden, following an emergency operation for appendicitis.

Born in San Francisco July 14, 1888, Mr. O'Connell had been a resident of Arizona for forty years. Entering the Highway Department of Arizona in 1913 as Assistant Highway Engineer, Mr. O'Connell attained national prominence in his chosen field.

Graduating from the University of Arizona, Mr. O'Connell attended West Point, being a member of the class of 1911. When the United States entered the World War in 1917, Mr. O'Connell was commissioned a captain and went overseas with the 91st Division.

Returning to Arizona in 1919, Mr. O'Connell resumed service with the Highway Department as location and construction engineer. He was appointed a District Highway Engineer in 1924 and in 1931 became State Highway Engineer.

Mr. O'Connell was a member of the board of directors of the American Road Builders Association and member of the executive committee of the American Association of State Highway Officials.

Surviving him are his widow, his mother, Mrs. H. L. Manning, Tucson, Arizona; a sister, Mrs. Fred Foster, Beverly Hills, California; and a brother, Howell Manning of Tucson.

Captain O'Connell was buried with military honors in Arlington cemetery, Washington, D. C.

Albert S. Kennedy

The death of Albert S. Kennedy on October 30, 1937, brings to an untimely end one of the faithful employees of the State of California, who for many years was engaged in the important work of supervising the construction of her bridges.

He was a capable engineer, honest and loyal to his State and loved by those who knew him. He taught his fellows by his example to be industrious, modest, kindly and considerate.

In spite of failing health he struggled on to do his bit of service to the very end and death found him still serving his fellow men.

He will be laid to rest in Oceanside while near at hand the San Luis Rey Bridge, which he helped build, will stand as a monument to his good name.

The spirit of Albert S. Kennedy lives in his good works.

Young Mother: "What makes you think our boy is going to be a politician?"

Young Father: "He says more things that sound well and mean nothing than any human being I ever saw."

Highway Bids and Awards for October, 1937

ALAMEDA COUNTY—Two grade separation crossings, one over the tracks of the Southern Pacific Co. at Redmond and the other under the tracks of the Western Pacific Railroad Co. at Stone Cut. District IV, Route 5, Section E. John Rocca, San Rafael, $103,329; C. W. Calletti & Co., San Rafael, $105,387; R. R. Bishop, Long Beach, $113,533; Barrett & Hilp, San Francisco, $117,749; Bodenhamer Construction Co., Oakland, $126,891; S. D. Bechtel, San Francisco, $145,806. Contract awarded to Heafey-Moore Co. and Fredrickson Watson Construction Co. and Fredrickson Bros., Oakland, $98,850.14.

BUTTE COUNTY—A bridge across Feather River about one mile west of Oroville to be repaired and about 0.09 mile of roadway to be graded and paved with Portland cement concrete pavement. District III, Route 21, Section A. W. K. Van Bokkelen Construction, Oakland, $28,441; C. W. Caletti & Co., San Rafael, $24,845; Lord and Bishop, Sacramento, $24,927; John Rocca, San Rafael, $25,706; Peter J. McHugh, San Francisco, $26,667. Contract awarded to M. A. Jenkins, Sacramento, $24,295.50.

CALAVERAS COUNTY—Between Stanislaus County line and Rock Creek via Milton, about 3.3 miles road-mix surface treatment to be applied to existing road. District X, Route—Feeder. A. R. Maestretti, Stockton $4,688; Piazza and Huntley, San Jose, $4,713; Claude C. Wood, Stockton, $4,890; Garcia Construction Co., Irvington, $5,043; Jones and King, Hayward, $5,502; George French, Jr., Stockton, $5,565; M. J. B. Construction Co., Stockton, $7,147. Contract awarded to J. P. Breen, Sacramento, $4,609.90.

CALAVERAS COUNTY—Between 2.5 miles east of Valley Springs and San Andreas about 6.1 miles to be graded and portions treated with liquid asphalt. District X, Route 24, Section B. Heafey Moore Co., Fredrickson Watson Construction Co., Fredrickson Bros., Oakland, $157,372; Claude C. Wood, Stockton, $142,547; Larsen Brothers and Harms Bros., Sacramento, $139,220; Piombo Bros. & Co., San Francisco, $171,701; Bodenhamer Construction Co., Oakland, $154,800; Hemstreet & Bell, Marysville, $137,381; Louis Biasotti & Son, Stockton, $139,915; J. R. Reeves, Sacramento, $174,586; Earl W. Heple, San Jose, $140,608; George Pollock Co., Sacramento, $141,487; Young and Son Co., Ltd., Berkeley, $146,380; D. W. Thurston, Los Angeles, $139,011. Contract awarded to Mountain Construction Co., Sacramento, $133,167.45.

CONTRA COSTA COUNTY—Walnut Creek Maintainance Site, maintenance buildings and appurtenances to be constructed. District IV, Route 75. Robert McCarthy, San Francisco, $9,432; A. Fredrick Anderson, Oakland, $9,732; Central California Construction Co., San Francisco, $9,645; Oliver S. Almlie, San Francisco, $9,292; Clinton G. Langum, Napa, $10,793; Edgar P. Seemans, Walnut Creek, $10,603. Contract awarded to Empire Construction Co., Ltd., San Francisco, $7,945.

EL DORADO COUNTY—A reinforced concrete girder bridge across Webber Creek about 2½ miles west of Placerville, consisting of three 71-foot spans and two 54-foot 6-inch spans on concrete bents and abutments. District III, Route 11, Section C. Hemstreet and Bell, Marysville, $42,143; John Rocca, San Rafael, $43,295; F. C. Amarosa and Sons, San Francisco, $48,270; W. K. Van Bokkelen Construction, Oakland, $49,401; S. D. Bechtel, San Francisco, $55,940. Contract awarded to Campbell Construction Co., Sacramento, $38,857.50.

INYO COUNTY—Between 1.1 miles east of Saline Valley road and Panamint Sink about 20.5 miles in length, penetration oiling to be applied to existing roadbed. District IX, Route 127, Sections E, F, G. Basich Bros., Torrance, $10,256; Oilfields Trucking Co., Bakersfield, $11,128; J. P. Breen, Sacramento, $15,512. Contract awarded to Paulsen and March, Inc., Los Angeles, $9,648.

INYO COUNTY—Between Diaz Lake and Alabama Gates, about 7.4 miles in length to be graded and surfaced with plant-mixed surfacing. District IX, Route 23, Section L. Griffith Co., Los Angeles, $89,468; Oswald Bros., Los Angeles, $83,357; A. S. Vinnell Co., Alhambra, $97,599; Geo. Herz & Co., San Bernardino, $97,604; C. O. Sparks and Mundo Engineering Co., Los Angeles, $141,467; Claude C. Wood, Stockton, $89,269; Fredericksen & Westbrook, Lower Lake, $96,637. Contract awarded to Basich Bros., Torrance, $70,637.30.

KERN COUNTY—About 20.6 miles south of Bakersfield, maintenance station buildings and appurtenances to be constructed. District VI, Route 4, Section B. Alva Hackney and Sons, Bakersfield, $12,154; Midstate Construction Co., Fresno, $14,208; Trewhitt-Shields and Fisher, Fresno, $14,172; D. A. Loomis, Glendale, $14,353. Contract awarded to William G. Gannon, Bakersfield, $10,809.

KINGS COUNTY—Between Hanford and Alcorn Bridge corner, about 6.4 miles to be paved with asphalt concrete. District VI, Feeder Road. Union Paving Co., San Francisco, $63,853; Griffith Co., Los Angeles, $68,151; Southern California Roads Co., Los Angeles, $71,910; Basich Brothers, Torrance, $73,618; Independence Construction Co., Ltd., Oakland, $78,799; N. M. Ball Sons, Berkeley, $79,641. Contract awarded to Piazza and Huntley, San Jose, $62,648.50.

LOS ANGELES COUNTY—Between Trancas Beach and Walnut Canyon about 1.6 miles to be graded and paved with Portland cement concrete and plant mixed surfacing. District VII, Route 60, Section A. George J. Bock Co., Los Angeles, $152,877; Basich Bros., Torrance, $184,592; Metropolitan Construction Co., Los Angeles, $146,929; Daley Corp., San Diego, $137,130; Claude Fisher Co., Ltd., Los Angeles, $139,826; Griffith Co., Los Angeles, $144,297; N. M. Ball Sons, Berkeley, $128,576; Dimmitt & Taylor, Los Angeles, $142,345; D. W. Thurston, Los Angeles, $130,365; George R. Curtis Paving Co., Los Angeles, $159,279; Oswald Bros., Los Angeles, $139,632; J. E. Haddock, Ltd., Pasadena, $132,682; C. O. Sparks & Mundo Engineering Co., Los Angeles, $127,378; Bodenhamer Construction Co., Oakland, $126,994. Contract awarded to Macco Construction Co., Clearwater, $123,349.

LOS ANGELES COUNTY—Between Encinal Canyon and Trancas Beach, about 3.2 miles to be graded and surfaced with plant-mixed surfacing and Portland cement concrete. District VIII, Route 60, Section A. Oswald Bros., Los Angeles, $266,532; Claude Fisher Co., Ltd., Los Angeles, $253,325; N. M. Ball Sons and D. McDonald, Berkeley, $236,101; Harold Blake, Whittier, $234,312; Daley Corporation, San Diego, $233,648; Metropolitan Construction Co., Los Angeles, $262,402; C. O. Sparks and Mundo Engineering Co., Los Angeles, $238,328; Pearson, Minnis and Moody, Los Angeles, $249,072; J. E. Haddock, Ltd., Pasadena, $242,598; D. W. Thurston, Los Angeles, $249,943; Fredericksen & Westbrook, Lower Lake, $249,154; Griffith Co., Los Angeles, $241,483; United Concrete Pipe Corporation, Los Angeles, $258,728. Contract awarded to Macco Construction Co., Clearwater, $228,807.50.

MADERA COUNTY—Maintenance buildings and appurtenances to be constructed at Coarse Gold. District VI, Route 125, Section D. Contract awarded to R. Hodgson & Sons, Porterville, $7,550.

MARIN COUNTY—Two bridges to be repaired about 4 miles north of Sausalito, one across Richardson Bay and the tracks of the Northwestern Pacific Railroad and the other across the tracks of the Northwestern Pacific Railroad near Alto. District IV, Routes 1 and 52, Sections C and A. Lee J. Immel, Berkeley, $43,811; John Rocca, San Rafael, $47,870; W. K. Van Bokkelen Construction, Oakland, $48,359; Bodenhamer Construction Co., Oakland, $48,429; C. W. Caletti & Co., San Rafael, $48,685; F. Kaus, Stockton, $48,747; Carl N. Swensen Co., San Jose, $51,391; F. C. Amoroso & Sons, San Francisco, $52,312; M. B. McGowan, Inc., San Francisco, $53,834; Peter J. McHugh, San Francisco, $56,575. Contract awarded to Macco Construction Co., Clearwater, $40,208.

MARIN COUNTY—Furnish and apply seal coat to existing pavement between Waldo and Golden Gate Bridge, about 3.4 miles. District IV, Route 1, Section D. Piazza and Huntley, San Jose, $4,185; Hayward Building Material Co., Hayward, $4,015; Lee J. Immel, Berkeley, $3,600; Pacific Truck Service, Inc., San Jose, $3,550; Macco Construction Co., Clearwater, $3,607; Tieslau Bros., Berkeley, $3,539. Contract awarded to E. A. Forde, San Anselmo, $3,252.50.

MENDOCINO COUNTY—A bridge across Garcia River 3.5 miles north of Point Arena consisting of one 120-foot steel truss span, one 66-foot two 50-foot and one 30-foot 6-inch steel beam spans on concrete piers with timber pile foundations to be constructed and approximately 0.4 mile in length to be graded, surfaced with imported material and penetration oil treatment applied. District I, Route 56, Section B. Chas. L. Harney, San Francisco, $71,625; C. W. Caletti & Co., San Rafael, $56,254; M. B. McGowan, Inc., San Francisco, $69,238; John Rocca, San Rafael, $62,229. Coutract awarded to Peter J. McHugh, San Francisco, $55,391.

MODOC COUNTY—Between Cedarville and State Line, across Middle Lake, about 1.4 miles, roadbed to be widened. District II, Route 28, Section C. Garcia Construction Co., Irvington, $4,320; Harms Bros., Litchfield, $4,986; Tieslau Bros., Berkeley, $6,012; Parish Bros., Los Angeles, $6,480; Hanraban Co., San Francisco, $12,456. Contract awarded to Poulos and McEwen, Trinidad, $3,600.

MONO COUNTY—Between Route 23 and June Lake, about 2.2 miles to be graded. District IX, Route 111, Section A. C. A. Baker, North Sacramento, $17,937; Basich Bros., Torrance, $19,422; George J. Bock Co., Los Angeles, $20,615; A. S. Vinnell Co., Alhambra, $21,792; Oswald Bros., Los Angeles, $22,528; Fredricksen and Westbrook, Lower Lake, $32,952. Contract

awarded to J. V. Galbraith and Don A. Canevari, Santa Rosa, $17,715.75.

PLUMAS COUNTY—Approaches to Spanish Creek Bridge near Quincy about 0.8 mile in length to be graded. District II, Route 21, Section C. W. K. Van Bokkelen Construction, Oakland, $18,386; Young & Son Co., Ltd., Berkeley, $19,170; Hemstreet & Bell, Marysville, $19,351; Claude C. Wood, Stockton, $19,520; Harms Bros., Litchfield, $19,615; Piazza & Huntley, San Jose, $20,-191; A. R. Maestretti, Stockton, $21,629; Guerin Bros., San Francisco, $23,262; Hanrahan Co., San Francisco, $29,707; Peter J. McHugh, San Francisco, $31,236. Contract awarded to Fredericksen and Westbrook, Lower Lake, $17,415.30.

RIVERSIDE AND SAN BERNARDINO COUNTIES—At the Palm Springs and Camp Angelus Maintenance Stations, maintenance station buildings and appurtenances to be constructed. District VIII, Routes 187, 190, Sections D, E. George Herz & Co., San Bernardino, $13,954; Andrew Archibald, Altadena, $12,999; Fred Walsh, San Bernardino, $13,158. Contract awarded to V. L. & W. B. Jacobson, Los Angeles, $11,601.

SACRAMENTO COUNTY—At Paintersville, repairing a bridge across the Sacramento River. District III, Route 11, Section E. Wm. C. Tait, San Francisco, $12,-954. Contract awarded to M. A. Jenkins, Sacramento, $7,928.

SAN BERNARDINO COUNTY—At the Lakeview Point maintenance site, maintenance station buildings and appurtenances to be constructed. District VIII, Route 43, Section C. Geo. Herz & Co., San Bernardino, $10,870; Fred Walsh, San Bernardino, $9,500. Contract awarded to V. L. and W. B. Jacobson, Los Angeles, $8,995.

SAN DIEGO COUNTY—Between Harasthy Street and Barnett Street in San Diego, placing plant mixed surfacing for 0.70 of a mile. District XI, Route 2, Section S.D. Contract awarded to R. E. Hazard and Sons, San Diego, $13,938; George R. Daley Corp., San Diego, $14,114. Contract awarded to V. R. Dennis Construction Co., San Diego, $13,246.

SANTA BARBARA COUNTY—Between easterly boundary and one mile north of Rincon Creek, about 1.0 mile existing roadbed to be widened and Portland cement concrete pavement to be constructed. District V, Route 2, Section H. Claude Fisher Co., Ltd., Los Angeles, $39,824; J. E. Haddock, Ltd., Pasadena, $40,155; Griffith Company, Los Angeles, $40,744; George R. Curtis Paving Co., Los Angeles, $42,917. Contract awarded to C. O. Sparks and Mundo Engineering Co., Los Angeles, $38,487.80.

TEHAMA COUNTY—At the Lost Creek maintenance site about 63 miles east of Red Bluff, maintenance station buildings and appurtenances to be constructed. District II, Route 29, Section C. Robert McCarthy, San Francisco, $7,488. Contract awarded to Liston Ehorn, Red Bluff, $6,500.

SAN BERNARDINO COUNTY—Between Los Angeles County line and Colton, about 19.3 miles to be graded and paved with asphalt concrete and Portland cement concrete. District VIII, Route 26, Section C.D,Ria.Col. Basich Bros., Torrance, $353,437; Southern California Roads Co., Los Angeles, $378,446; N. M. Ball & Sons, D. McDonald, Berkeley, $367,302; Harold Blake, Whittier, $364,339; Gibbons and Reed Co., Burbank, $418,850; David H. Ryan, San Diego, $331,813; Oswald Bros., Los Angeles, $331,676; W. E. Hall Co., Alhambra, $389,652; Daly Corp., San Diego, $348,850; Metropolitan Construction Co., Los Angeles, $368,002; C. O. Sparks and Mundo Engineering Co., Los Angeles, $379,-488; J. E. Haddock, Ltd., Pasadena, $374,-298; D. W. Thurston, Los Angeles, $353,-606; Griffith Co., Los Angeles, $335,028; United Concrete Pipe Corporation, Los Angeles, $371,533. Contract awarded to Matich Bros., Elsinore, $318,226.



Instrumentman W. C. Names and painted level tripod in use in District IX.

SAN JOAQUIN and SACRAMENTO COUNTIES—Two reinforced concrete slab bridges across Dry Creek, about one mile east of Galt, one consisting of seven 22-foot spans, one 15-foot span, and two 7-foot 6-inch spans, and the other consisting of thirty-four 22-foot spans, five 15-foot spans, two 7-foot 6-inch spans, all supported by reinforced concrete pile bents. District X, Route 4, Sections D,A. R. R. Bishop, Long Beach, $75,956; A. Soda and Son, Oakland, $84,847; Barrett & Hilp, San Francisco, $93,395; Heafey Moore Co. and Fredrickson & Watson Construction Co. Fredrickson Bros., Oakland, $75,003; F. C. Amaroso and Sons, San Francisco, $81,049; S. D. Bechtel, San Francisco, $91,489; John Rocca, San Rafael, $73,552; John Strona, Pomona, $71,123; A. Teichert and Son, Inc., Sacramento, $83,391; Campbell Construction Co., Sacramento, $73,128. Contract awarded to Lord and Bishop, Sacramento, $68,602.

SAN LUIS OBISPO COUNTY—Between Atascadero Summit and San Gabriel Avenue, about 2.8 miles to be graded and road-mix surface treatment to be applied. District V, Route 125, Section A. D. W. Thurston, Los Angeles, $151,368; Crow Bros. Construction Co., Los Angeles, $142,-338; Claude Fisher Co., Ltd., $157,707; Hemstreet & Bell, Marysville, $140,848; A. Teichert & Son, Inc., Sacramento, $127,-709; Macco Construction, Clearwater, $126,-526; Young and Son Co., Ltd., Berkeley, $122,523; Biasotti & Son, Stockton, $132,-265. Contract awarded to George K. Thompson & Co., Los Angeles, $121,413.45.

Frosh: "If I had known that the tunnel was so long I would have kissed you."

Ditto: "Good heavens! Wasn't that you?"

Gaudy Colors On Tripods Protect Road Surveyors

By MILTON HARRIS
Associate Highway Engineer

MOTORISTS traveling through District IX may wonder what artistic leanings prompted highway survey crews to paint alternate red and white bands on the tripods of their transit and level sets.

The surveyors of District IX have not taken up futuristic art. They have a very logical reason for painting their tripods in gaudy colors.

Protection of a survey crew on heavily traveled roads is always a responsibility devolving upon a Chief of Party. Due to the rapidity with which a survey crew moves, it is often impossible to keep suitable warning signs, such as "Men At Work," at correct distances from the party.

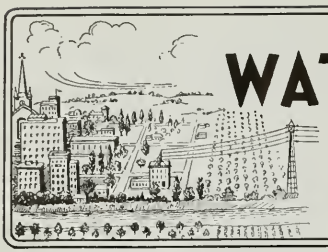
Not infrequently a motorist, having passed a warning sign some distance back, will round a curve in the highway and find himself bearing down on a surveyor and his tripod. The usual plan is for the instrumentman to stand astraddle of a tripod leg while a car is passing his instrument too close for safety. A driver will instinctively avoid hitting a human but may not be averse to driving too close to an inanimate object such as a tripod.

As a safety measure to protect not only the surveyor and his instrument but motorists as well, District IX is painting red and white bands on all its tripods.

Hopkins Appointed Assistant Director

(Continued from page 5)

In 1910, Mr. Hopkins organized a public utilities company and installed a municipal water system, later forming an ice company of which he has been manager and secretary-treasurer ever since. As a founder of the Kern County Chamber of Commerce, Mr. Hopkins served as chairman of its finance and highway committees and since that time has been prominently identified with and interested in California's highway development.



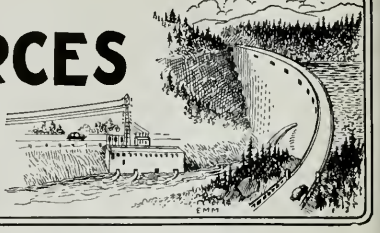
DIVISION OF WATER RESOURCES

OFFICIAL REPORT

FOR THE MONTH OF

October, 1937

EDWARD HYATT, State Engineer



IRRIGATION DISTRICTS

The irrigation season is now drawing to a close and plans are under way in many districts to resume repair work and improvements on canals and structures as soon as the water is no longer needed. During the last few years this type of winter work has furnished employment to a large number of men, and the districts have made full use of W. P. A. cooperation on their projects.

South San Joaquin Irrigation District has awarded a contract for purchase of 6000 barrels of cement to be used in concrete lining canals.

Construction work on a drainage project in the West Side District was investigated and reported upon to the Securities Commission. Contributions toward the work are being made by the State Highway Department, San Joaquin County, the Southern Pacific Railroad, and several of the larger oil companies.

On October 22, the La Mesa, Lemon Grove and Spring Valley District celebrated completion of its El Monte pumping station which will lift water from the pipe lines leading from El Capitan Reservoir into the district's distribution system. A large pipe line replacement project in this district will also be under way within the next few weeks.

FLOOD CONTROL AND RECLAMATION

Maintenance of Sacramento Flood Control Project

On Pump No. 4 at Pumping Plant No. 2 east of the Sutter By-Pass, the Worthington Pump Company installed a steel hood over the suction inlet to prevent the formation of a vortex.

Sacramento Flood Control Project

Bids will be opened on November 8, for filling the borrow pit on the Burr Mitchell property on the right bank of the Sacramento River north of Colusa. This involves placing of 66,700 cubic yards of sand and earth material. The work is being done at the request of the State Reclamation Board and in connection with right-of-way procurement for the river levee.

Flood Measurements and Gages

All of the water stage recording stations and metering stations maintained and operated by this division are now in condition for the coming flood season. Improvements at the Mawson Bridge and Gridley stations have been completed with the installation of continuous water stage recording instruments.

SUPERVISION OF DAMS

Application for approval of the plans and specifications for the construction of the Bonita Canyon Dam of the Irvine Company was filed on September 28, 1937. This is to be an earth structure 43 feet in height with a storage capacity of 295 acre-feet, situated on Bonita Creek, a tributary to Newport Bay in Orange County. The estimate cost is $26,000.

Amended application was filed on October 13, 1937, by the Whiting Company for approval of the plans and specifications for the construction of Whiting Dam in Orange County. This dam is to be an earth structure 31 feet in height with a storage capacity of 220 acre-feet. The estimated cost is $20,000. Construction or repair plans were approved for the Stinson Weir Dam on North Fork of Kings River in Fresno County; Henshaw Dam on San Luis Rey River in San Diego County; Empire Weir No. 1 Dam on the South Fork of Kings River in Kings County; Bean Hollow No. 2 Dam of the Shoreland Properties, Inc., on Arroyo de Los Frijoles in San Mateo County; Evans Creek Dam of the Tuolumne Gold Dredging Company on Evans Creek in Stanislaus County.

WATER RIGHTS

Supervision of Appropriation of Water

Thirty applications to appropriate water were received during the month of September and ten were denied and eighteen approved. In the same period five permits were revoked and the rights were confirmed in five cases by the issuance of licenses.

Among the applications received were two by the San Gabriel Valley Protective Association of Whittier proposing appropriations of 200,000 acre-feet per annum on San Gabriel River by spreading for percolation to ground water between Morris Dam and Imperial Highway, the water to be recovered later by pumping for irrigation, domestic and municipal purposes.

Field work in connection with the investigation of protested cases and projects under permit was completed during the month. A total of 190 projects, distributed throughout all counties of the State except eight, were investigated during the season.

SACRAMENTO-SAN JOAQUIN WATER SUPERVISION

During the past month the efforts of the field men from this office have been devoted almost entirely to gathering data relative to the acreage irrigated during the past season with water diverted from the streams in the Sacramento and San Joaquin valleys. The acreage data will be used to determine the use of water in the same area and will be incorporated in the report of this office. This report will also show the amount of return flow and flow from the valley streams.

The sampling of water in the delta for salinity is being carried on at a sufficient number of stations to record the rate of advance or retreat of the salinity. At intermittent intervals samples of drainage and return flow water are being obtained in the Sacramento and San Joaquin valleys.

The cool weather delayed the rice harvest somewhat but in many instances the harvesting of the crop is completed.

The flow of the Sacramento River at Sacramento on October 23 was about 7600 c.f.s. and has been at that stage since about the first of October. The flow of the San Joaquin River at Vernalis on October 23 was about 2000 c.f.s. and has been at that stage since the first week in October. For purposes of comparison, some stream flow and salinity figures follow:

CALIFORNIA COOPERATIVE SNOW SURVEYS

During the past month work has been directed toward concluding arrangements with the personnel of the various cooperating agencies throughout the State for the conduct of next winter's snow surveys.

Arrangements were concluded with Superintendent Merriam of Yosemite National Park for the park rangers to make the annual survey at nine snow courses within the park boundaries.

The seven shelter cabins on the South Fork of the Kings River have been stocked with food and supplies for the winter as have the five cabins on the North Fork, including the one just completed this summer at Loggy Meadows. The cabins at Pinte Pass and Bishop Pass have also been stocked. Supplies are on hand for stocking the cabins in the American and Pit River watersheds and these as well as the balance of unstocked cabins throughout the State will be made ready for the winter's surveys within the next few weeks.

(Continued on page 28)

Grader Blade Level Devised for Oil Mix

By H. J. DOGGART
Resident Engineer

IN THE construction of road-mix oil shoulders on the recently completed Contract 85TC2-45CN3, Road V-Mon-2-H,I, between Bradley and San Ardo, two factors necessitated the development of a device to regulate the height of the cutting edge of a grader blade with reference to the grade of the finished concrete pavement.

First, it was desired to regulate accurately the depth of the shoulder trench in which oil mix shoulder material was to be placed; and second, in order to provide for settlement which invariably occurs on oil mix shoulders after being turned over to traffic where the shoulders have been finished to the grade of pavement, it was desired to cut the compacted shoulders to an even one-half inch above pavement grade.

ATTACHMENT DEVISED

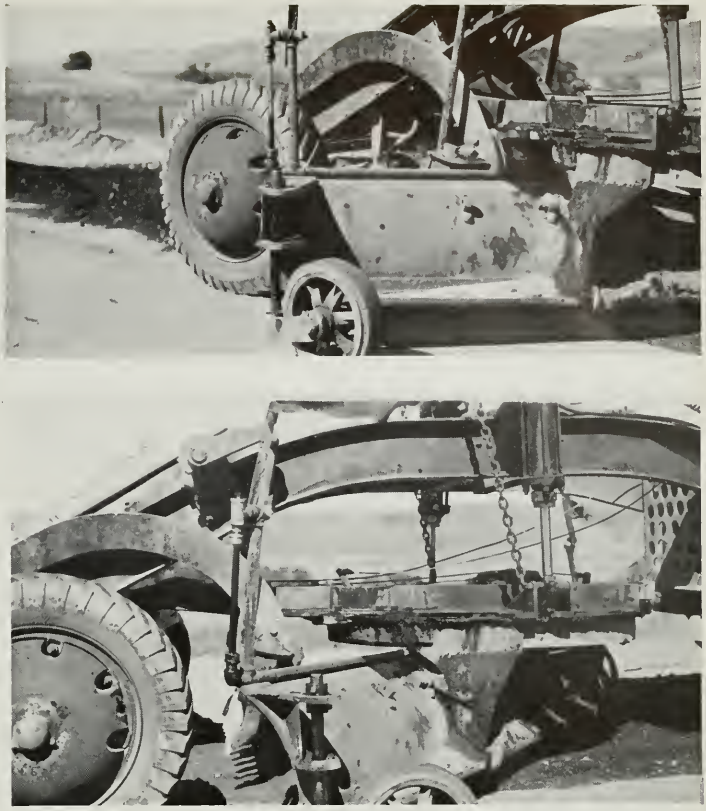
At the writer's suggestion, the contractor's mechanic constructed an attachment to the mold-board of a motor blade grader which gave positive control in regulating the height of blade in relation to pavement grade.

This device was patterned after a caster wheel and consisted of a solid rubber-tired wheel of 2-foot diameter, with swivel action, attached to one end of the mold-board by means of a bracket welded to same. This bracket was constructed of two horizontal $\frac{5}{8}$ inch sheet steel plates, spaced 12 inches apart and reinforced with a vertical web.

Each steel plate was bored to permit a one inch vertical shaft, to which the wheel was attached, to pass through. The lower end of this shaft was curved as in the case of a caster, before being attached to the wheel mounting. The position of the wheel relative to grade was firmly fixed by means of two collars, one on each side of the upper bracket and held in place on the one inch shaft by set screws.

The wheel rode on the pavement surface, and because of its swivel action, the blade could be set at any desired angle without binding action on the regulating wheel. Where it was desired to trench alongside the pavement, a section of the grader blade was cut out in order to allow a portion of the mold-board to project over the pavement. A blade with the full length of the mold-board was used where it was desired to make the final cut on the oil shoulders.

The blade leveling device shown on the accompanying photographs was used throughout the shoulder construction on this contract and was patterned after a model suggested by the Construction Department in January, 1931, except that light lubricating oil was used in place of water. The advantage of oil over water was in greater visibility and the fact that the jolting of the grader did not affect the stability of the fluid in the indicating column, as was the case where water was used. The Peninsular Paving Company, was the contractor.



Two views of leveling device on mold-board of grader. Upper picture shows device attached to adjustab'e wheel. Lower is a closeup of device and mold-board.

It has been estimated that travel by motor car, motor bus and railroad in the United States in 1936 reached a total of 236,000,000,000 passenger-miles, or about 1,840 miles per capita.

Doctor: "Humph! I can't quite diagnose your case. I think it's drink."

Patient: "Oh, I see. Now, look here, doctor. Would you like me to come again when you're sober?"

She: Did anyone ever tell you how wonderful you are?

He: No, I don't think anyone ever did.

She: Then I'd like to know where you got the idea.

Quarterly Gas Tax Paid to Cities

(Continued from page 15)

District X

City	Population	Amount
Amador County:		
Amador City	171	$41.48
Jackson	2,005	486.38
Plymouth	343	83.21
Sutter Creek	1,013	245.74
Totals	3,532	$856.81
Calaveras County:		
Angels Camp	915	$221.96
Mariposa County:		
Hornitos	62	$15.04
Merced County:		
Atwater	917	$222.45
Dos Palos	930	225.60
Gustine	1,016	246.47
Livingston	803	194.79
Los Banos	1,875	454.85
Merced	7,066	1,714.10
Totals	12,607	$3,058.26
Sacramento County:		
Isleton	2,906	$704.95
San Joaquin County:		
Lodi	7,277	$1,765.29
Manteca	1,614	391.53
Stockton	47,963	11,635.08
Tracy	3,829	928.85
Totals	60,683	$14,720.75
Solano County:		
Benicia	2,913	$706.65
Dixon	1,000	242.59
Fairfield	1,131	274.36
Rio Vista	1,309	317.54
Suisun	905	219.54
Vacaville	1,556	377.46
Vallejo	15,277	3,705.96
Totals	24,091	$5,844.10
Stanislaus County:		
Ceres	981	$237.98

District X—Continued

City	Population	Amount
Modesto	13,860	$3,362.22
Newman	1,269	307.84
Oakdale	2,112	512.34
Patterson	905	219.54
Riverbank	803	194.79
Turlock	4,276	1,037.29
Totals	24,206	$5,872.00
Tuolumne County:		
Sonora	2,278	$552.61
Totals District X	131,280	$31,846.48

District XI

Imperial County:		
Brawley	10,439	$2,532.34
Calexico	6,299	1,528.04
Calipatria	1,554	376.98
El Centro	8,434	2,045.96
Holtville	1,758	426.46
Imperial	1,943	471.34
Westmorland	1,476	358.05
Totals	31,903	$7,739.17
Riverside County:		
Blythe	1,020	$247.44
Indio	2,601	630.96
Totals	3,621	$878.40
San Diego County:		
Chula Vista	3,869	$938.56
Coronado	5,425	1,316.02
El Cajon	1,050	254.71
Escondido	3,421	829.88
La Mesa	2,513	609.62
National City	7,301	1,771.11
Oceanside	3,514	852.44
San Diego	151,694	36,798.60
Totals	178,787	$43,370.94
Totals District XI	214,311	$51,988.51

H. R. Judah, New Highway Chairman

(Continued from page 5)

ing and travel information agency. H. R. Judah took up the duties of manager of the southern branch of the company in Los Angeles.

Following the San Francisco fire of 1906, Mr. Judah returned to Santa Cruz where he had formerly resided and was appointed manager of the chamber of commerce, a position he had previously held.

In 1907, Mr. Judah and Edward J. Devlin, then managing editor of the Sacramento Bee, decided to engage in the newspaper publishing business as partners and on November 1 of that year they established the Santa Cruz Evening News, a daily newspaper which they have operated successfully since that date.

Throughout the years of his participation in public affairs in Santa Cruz, Mr. Judah has been greatly interested in highway matters in the central coast section of the State and it was because of his zeal in the development of good roads that Governor Merriam named him on the California Highway Commission to succeed Timothy A. Reardon, resigned.

"If you were ordered to disperse a mob, what would do?"

Aspirant for police job: "Pass my hat!"

Water Resources for October, 1937

(Continued from page 26)

CENTRAL VALLEY PROJECT

The Division of Water Resources, under an agreement with the Bureau of Reclamation, has continued surveys and the collection and compilation of data in the San Joaquin Valley in connection with the acquisition of lands and water rights.

The United States Bureau of Reclamation continued the construction of the government camp for the Friant Dam and work was started on the construction of the camp for the Shasta Dam. Certain difficulties in securing rights of way for the Contra Costa Conduit were adjusted during the month and construction work was started on a portion of the canal.

STATE OF CALIFORNIA

Department of Public Works

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HARRY A. HOPKINS.....Assistant Director

EARL LEE KELLY.....Director

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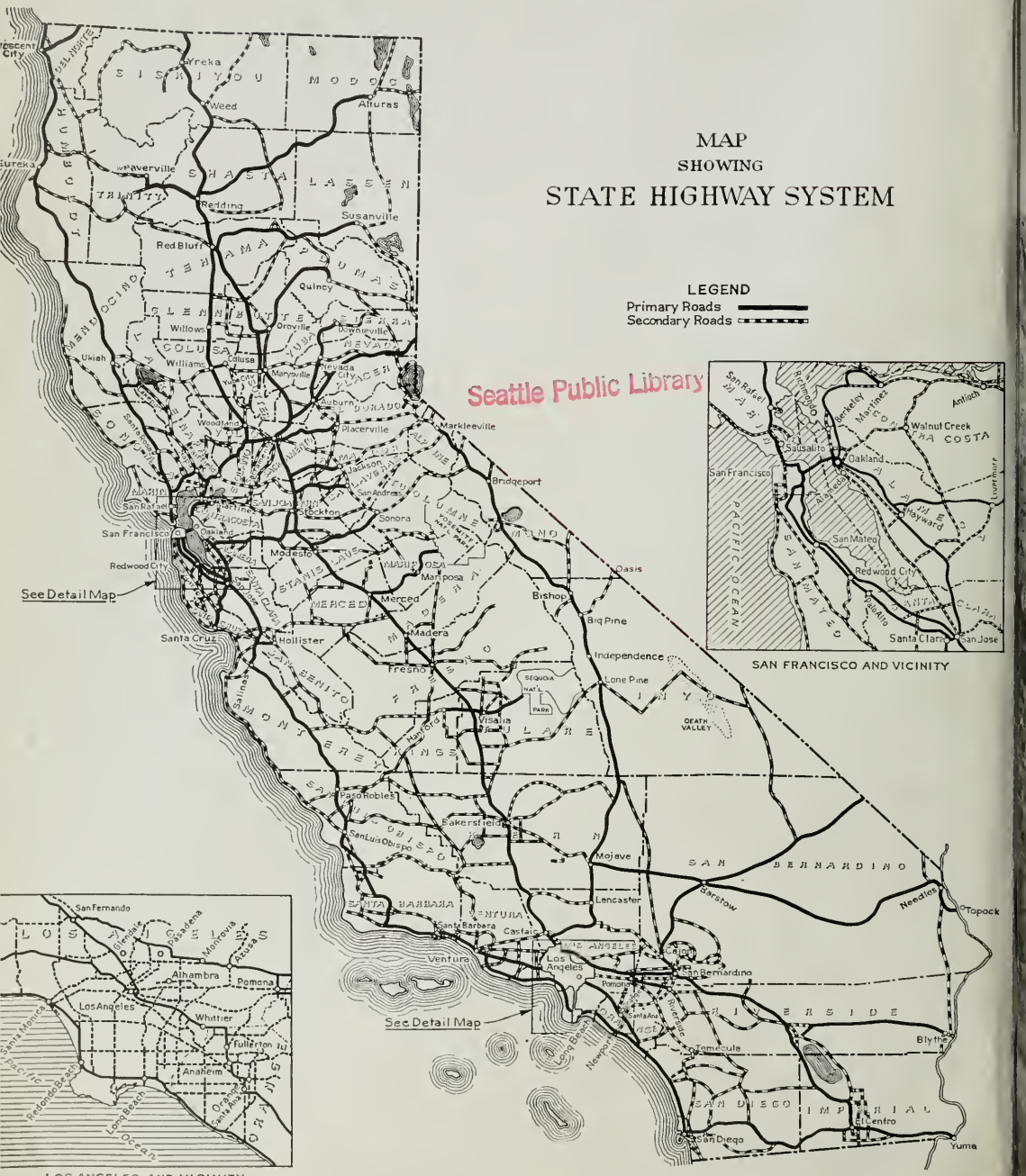
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Official Journal of the Department of Public Works
DECEMBER · 1937

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CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways of the Department of Public Works, State of California

EARL LEE KELLY, Director C. H. PURCELL, State Highway Engineer JOHN W. HOWE, Editor K. C. ADAMS, Associate Editor

Published for information of the members of the department and the citizens of California

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Vol. 15 DECEMBER, 1937 No. 12

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Pedro Mountain Section of New Scenic Road Entailed Difficult Construction Work

Ocean Shore Highway Job Is Completed

By JNO. H. SKEGGS
District Engineer

ON ARMISTICE DAY, November 11, 1937, one of the most difficult highway construction projects, and probably the most important section of the so-called "Ocean Shore Highway" between San Francisco and Santa Cruz, was opened to public travel.

District Construction Engineer E. G. Poss, in an article appearing in the June, 1937, issue of this magazine, briefly described the nature of, and a few of the construction problems on this project. Accompanying the referred-to article was a sketch-map showing the alignment, and a photograph of the former county road with its 250 curves, involving 42.2 complete circle-turns in its 10.6 miles of length, with a total rise and fall of 2,409 feet.

The importance of this portion of the Ocean Shore Highway, commonly referred to as the "Pedro Mountain" section, was aptly portrayed by the twenty-eight curves involving only 3.8 circle-turns and 1,225 feet of total rise and fall in grade in the new length of 5.9 miles covered by this construction project.

TIME AND DISTANCE SAVED

The saving of 4.7 miles in distance does not truly reveal the convenience afforded the traveling public by this new road. The former road, for almost its entire length, gave no sight distance to the motorist, who, in averaging fifteen miles per hour throughout the entire length, was making good progress. The highway will permit speeds throughout its entire length averaging close to the legal speed limit of 45 miles per hour, and will affect a saving in travel time of more than one-half hour to all motorists destined south of Farallone City.

This highway will therefore assume great importance, not only as a recreational road between San Francisco and the beaches and redwood-covered mountain slopes of the Santa Cruz Peninsula, but also as a market artery in transportation of the truck garden, dairy and stock-raising products of the rich agricultural area centering about the coast towns of Half Moon Bay, Pescadero, Tunitas and San Gregorio.

SCENIC HIGHWAY

The scenic nature of the new highway is portrayed by the cover-page photograph on this magazine, which shows it to be comparable in this respect to the newly-opened Carmel-San Simeon scenic coast route.

From a construction standpoint, the project involved one and one-half million cubic yards of roadway excavation, or an average of approximately one-quarter million cubic yards per mile. These quantities include approximately 700,000 cubic yards of material removed outside the original typical roadway section, principally slides occurring at the famous "Devil's Slide" on Pedro Mountain, near the center of the project. Some daylighting of small cuts was included at vantage points, to give the motorist the full benefit of the marine view, and to increase the sight distance as a safety precaution.

Rubble masonry walls played an important part in retaining the roadbed at control points on the steep mountain slopes. These were constructed in preference to concrete walls, due



Looking down valley from Pedro Mountain Summit. This section of road is typical of new Ocean Shore Highway which will benefit tourists and agriculturists alike, saving time and distance.



View of Ocean Shore Highway 1½ miles south of Rockaway Beach. The old county road is shown on left.

to the availability of rock, from the standpoint of economy of construction, and also to keep the nature of the improvement in line with the scenic features of the rugged coast country traversed. Approximately 700 lineal feet of rubble masonry parapet walls were constructed on top of the rubble masonry retaining walls supporting the roadbed, a job itself. As is so common in the north coast section of California, where all formations have been shaken and disturbed in earthquakes of the past, providing stability of the roadbed calls for the solution of more difficult problems in the construction of large fills than it does in excavating the material from large cuts. The present project presented a problem in the construction of a fill approximately 85 feet in depth at the centerline, involving approximately 100,000 cubic yards of material in place.

Within a length of 400 feet along the roadway, it was necessary to strip approximately 4000 cubic yards of



View looking northeasterly from intersection of county road with new Ocean Shore Highway.

unstable top soil, and to excavate trenches 12 feet in width and up to 20 feet in depth, involving approximately 12,000 cubic yards additional excavation.

These trenches, consisting of one transverse, two longitudinal and one diagonal ditch, explored the natural drainage courses of a number of underground springs, and were led into one outlet trench and backfilled with large rock placed directly on the supporting rock, to insure the free drainage of the entire area beneath this important fill. Approximately 9000 cubic yards of rock was placed in these trenches prior to the starting of construction on the fill.

Another special construction problem in providing a stable roadway was presented at a location where the typical section lay almost entirely in excavation. The roadway section, for approximately 150 feet of length, was trenched into the mountain side, but the slopes below the roadway were so steep and of such unstable material that it was considered necessary to excavate to a maximum depth of some 40 feet below grade on the lower side, to trench the mountain slopes and carefully rebuild the fill to grade, entirely out of large rock anchored into a stable portion of the mountainside.

In spite of all the precautions taken from an engineering standpoint to provide a stable roadway, as free as possible from major slides both in cut and fill sections, it is anticipated that considerable trouble will be experienced by our maintenance forces during the next two or three winters, in keeping the roadway clear of minor slides and the natural sloughing of material from the steep mountain slopes.

The maximum slide occurring on this project during construction broke at a point about 600 feet (measured horizontally) and approximately 500 feet (measured vertically) from the grade of the roadbed. At this same point, the roadbed is about 330 feet above the ocean waters, with a slope below the road to the ocean.

Granfield, Farrar & Carlin were the contractors, and H. A. Simard was the resident engineer for the state on this project.



This picture vividly illustrates difficult construction on Ocean Shore Highway on Pedro Mountain.

San Francisco-Oakland Bay Bridge Is Year Old

WHEN the hands of the clock pointed to 12:30 p.m. on Friday, November 12, the San Francisco-Oakland Bay Bridge was one year old.

Within twelve months approximately 9,250,000 vehicles, carrying more than 20,000,000 persons, had crossed the great span, State Highway Engineer C. H. Purcell reported to Earl Lee Kelly, State Director of Public Works.

The Bridge had earned more than $5,000,000—placing the structure first among the toll bridges of the world in point of earnings. It ranks third in volume of traffic. A daily average of 25,200 vehicles had crossed the bridge during the year, while over its truck lanes approximately 325,000 tons of freight were transported.

Added also to its other records is that of safety. Out of 9,022,099 vehicles crossing the bridge from November 12, 1936, to November 1, 1937, there were only 34 accidents occurring on the bridge proper which involved personal injury. And out of less than 20,000,000 crossing, only 69 received injuries in accidents on the bridge. There have been 4 fatal accident on the span.

Primary Road Upkeep Costly

Maintenance of primary highways is costing the forty-eight states more than $170,000,000 annually, according to the National Highway Users Conference.

The conference has just completed a comprehensive study of state expenditures throughout the nation for highway upkeep. Primary highways, the conference report says, include both surfaced and unsurfaced roads, maintained at state expense, and are those which carry virtually all the commercial traffic.

"How about the last dance, baby?"
"Fellah, you jes' had the last dance!"

Broadway Tunnel Opened and State Assumes Maintenance

By P. O. HARDING, Assistant District Engineer

CONSUMMATING 11 years of planning and difficult construction work, Governor Frank F. Merriam on Sunday, December 5, amidst pageantry and jubilation officially opened the $4,500,000 Broadway Low Level Tunnel connecting Alameda and Contra Costa counties.

Cooperation of the Federal government and the State of California with Joint Highway District No. 13 comprising Alameda and Contra Costa made possible completion of the project. A PWA grant of $1,095,000 and a State contribution of gas tax moneys amounting to $700,000 added to funds raised by the two counties financed the undertaking. The State assumes maintenance of the tunnel as a unit of the highway system.

A community breakfast at the Claremont Hotel in Berkeley Sunday morning, which was attended by 900 Federal, State and county officials, civic leaders of the East Bay area, celebrants and invited guests, a Spanish fiesta at the tunnel's western portal and programs of speech making at both ends of the big bore featured the celebration.

T. E. CALDECOTT HONORED

The dedication ceremonies were arranged by the Oakland Junior Chamber of Commerce under the direction of the organization's president, Edwin W. Geary.

At the breakfast, Thomas E. Caldecott, president of Joint Highway District No. 13, was honored as the man who, above all others, is responsible for the success of the project. Mr. Caldecott was presented with a copper bucket, suitably engraved, containing some of the earth spaded up when the venture was launched.

In an address at the west portal of the tunnel Governor Merriam praised the cooperative spirit exhibited by the national government, the State and the counties of Alameda and Contra Costa. He said the project had been made possible by the gas tax which the people of California gladly pay for highway construction and maintenance.

FEDERAL AID CUT DENOUNCED

Governor Merriam deplored the proposal made in Washington under which the states would be deprived of Federal aid appropriations for roads and highways.

"We have been receiving great aid from the government in highway financing," the Governor said. "It is now proposed that Federal contributions be gravely curtailed. I urge all of you to write your Congressmen and Senators in Washington demanding that the Federal aid funds be not withdrawn."

(Continued on page 12)



Sketch map shows location of Broadway Tunnel and Berkeley connections. Old Tunnel Road shown by wavy dotted line.



Broadway Low Level Tunnel Project. Upper—Landvale overhead across west approach to tunnel. Center left—West portal of bore. Center right—State highway leading from Moraga Junction to east portal. Lower—Twin tubes of tunnel and lighting system.



Attractive view looking across Lake Mary from new Mammoth Lakes Highway in Mono County.

NEW MOUNTAIN HIGHWAY



Photograph taken from Mammoth Lakes Highway shows Twin Lakes and new highway in distance.

By F. R. PRACHT
Associate Highway Engineer

THE surfacing under contract with the State Division of Highways, of the portion of highway joining the main north and south State Route Twenty-three with the Mammoth Lakes region in Mono County, finished November 4th, opens up another section of the High Sierra scenic wonderland to the motorist over a modern highway.

The grading of this highway was completed last year at a cost of $60,000 by the U. S. Bureau of Public Roads and was recently taken over by the State Division of Highways.

Leaving Route Twenty-three near Casa Diablo Hot Springs at an elevation of about seventy-two hundred feet, one climbs in nine miles of high gear highway, the maximum grade being less than 6 per cent and the minimum radius curve 400 feet, to an elevation of nine thousand feet and to the very heart of a section of the High



Scene on Mammoth Lakes Highway where it crosses ornamental bridge structure. Sierra glaciers in background.

LEADS UP TO SIERRA LAKES

Sierras which was until recent years only accessible by pack train.

HIGHWAY BORDERS LAKES

The highway borders on four lakes in the most westerly three miles with numerous other lakes and streams within easy hiking distance for those who prefer this mode of transportation to the pack train.

The jagged peaks rising to a height of over twelve thousand feet come down to the very shores of these tree-lined lakes and are spotted with snow even in mid-summer.

The highway consists of a thirty foot graded roadbed with the center twenty feet paved with a road-mix surfacing three inches in depth bordered with select material shoulders.

The major contract items were 15,400 cubic yards of imported surfacing material, 7600 cubic yards select material for shoulders and 975 tons of SC-3 road oil and represents an estimated expenditure of $50,000.

Tourists are expected to take full advantage of the new road.



Scenic stretch of new Mono highway showing heavy timber growth. Lake Mary in background.



Artist's conception of new type of reflecting curb for intersectional islands and division strips. Upper inset shows wedge shaped recess for separation strip curbs. Lower inset shows block type recess under direct headlight rays.

New Type of Reflecting Curb Designed

By F. J. Grumm, Engineer Surveys and Plans

TO REDUCE the hazards of night driving, the Division of Highways has designed a new type of curb. This curb will reflect the light from the headlights of a car, thus increasing its visibility and more clearly marking the marginal limits of the roadway.

In the development of highways with multiple lanes separated by a dividing strip, efficiency and safety of the facility that is designed principally as a safeguard against head-on collisions also depends upon the provisions made for facilitating and safeguarding movements on the roadways each side of the dividing strip.

In each roadway the traffic lane widths have been increased to a minimum of 11 and 12 feet, traffic stripes are placed, and, where conditions are suitable, adjacent traffic lanes are constructed of types that show contrast in surface appearance. The curbs that border the separated roadways constitute the more important feature in guiding traffic.

Under normal daylight driving conditions when visibility of the road and of the above features obtains, satisfactory results can be expected. In the case of night driving, however, the effectiveness of traffic stripes and the conventional type of curbs is reduced, especially in cases where the separation strip is limited in width, glare of opposing headlights has a blinding effect, or visibility is decreased in fogs or storms. Then the specularity of the separation curbs which define the limits of the traffic lane becomes of increasing importance, particularly inasmuch as the lane adjacent to the curb is the high speed or passing lane.

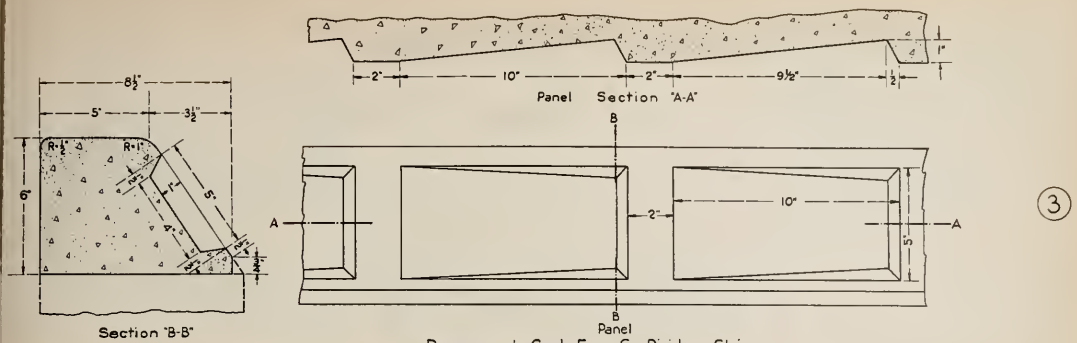
CURB DESIGN STUDIES

Studies have been made of curb design in an endeavor to improve its effectiveness and visibility at night or during adverse weather conditions. Curb sections were constructed with various dimensions, slope batters, face designs and paint combinations.

The best results for visibility of the curb under all driving conditions were obtained by making small recesses in the face of the conventional curb. Curbs were constructed with different forms, widths, spacings and angles of recesses.

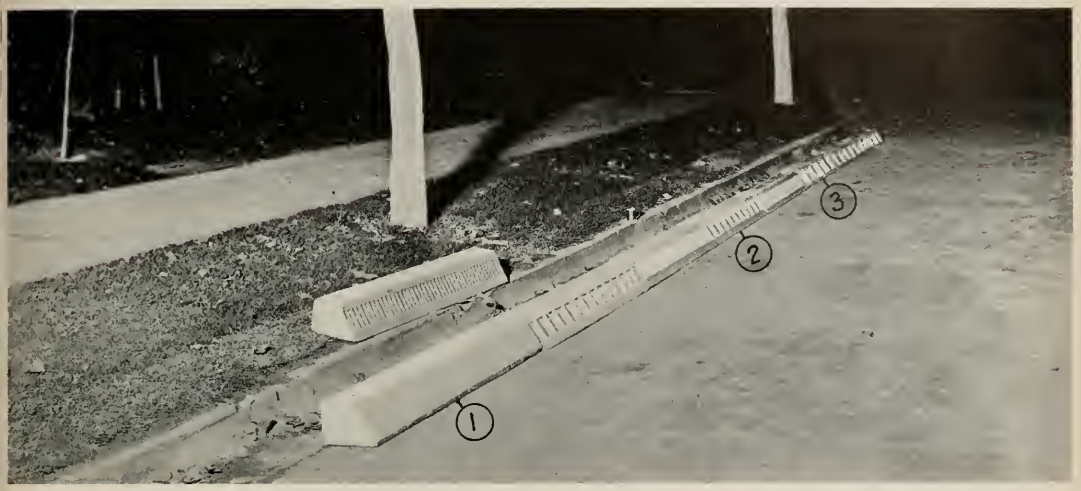
By observation of direct comparison it was clearly demonstrated that

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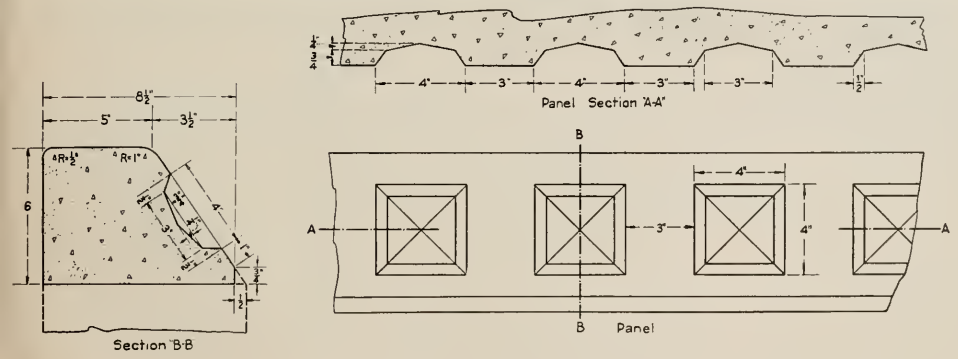


3

Recessed Curb Face for Dividing Strip



Three types of curb. 1—Section of standard conventional curb. 2—Block type recess proposed for curb returns and intersection islands. 3—Wedge shaped recess for separation strip curbs.



2

Recessed Curb Face for Curb Return or Island Section

Eighteen Bridge Structures Will Span Arroyo Seco Parkway

By C. W. JONES, Senior Bridge Engineer, Southern Office

EIGHTEEN traffic separation structures which will be built over the new Arroyo Seco Parkway will separate grades at all highway and railroad crossings on the new nine-mile highway to be constructed from the Figueroa Street Viaduct in Los Angeles to Glenarm Street in Pasadena, and will make it possible for through traffic to safely travel this nine mile course in about twelve minutes. This is less time than it ordinarily takes traffic to travel nine blocks along Broadway Street in down town Los Angeles.

This shortening of travel time will link the communities to the northeast more closely to Los Angeles and will greatly encourage the development of such communities as the Highland Park District, South Pasadena, Pasadena, Sierra Madre, Altadena and all others between Pasadena and San Bernardino having traffic tributary to Foothill Boulevard.

With these separations this road will become the fastest and most direct route leading from Los Angeles to the Rose Bowl game and to Pasadena's Tournament of Roses. It will greatly relieve traffic congestion which has occurred in the past on New Year's Day.

The eighteen separation structures will conduct cross traffic and railroad traffic over the new highway. This will eliminate boulevard stops which consume so much travel time in densely populated areas. It will eliminate all cross traffic congestion. It will eliminate delay and hazard at railroad crossings. It will eliminate street intersection accidents. It will make possible the full use of the new highway for free uninterrupted flow of through traffic.



Artist's drawing of bridge which will be typical of several planned for Arroyo Seco Parkway.

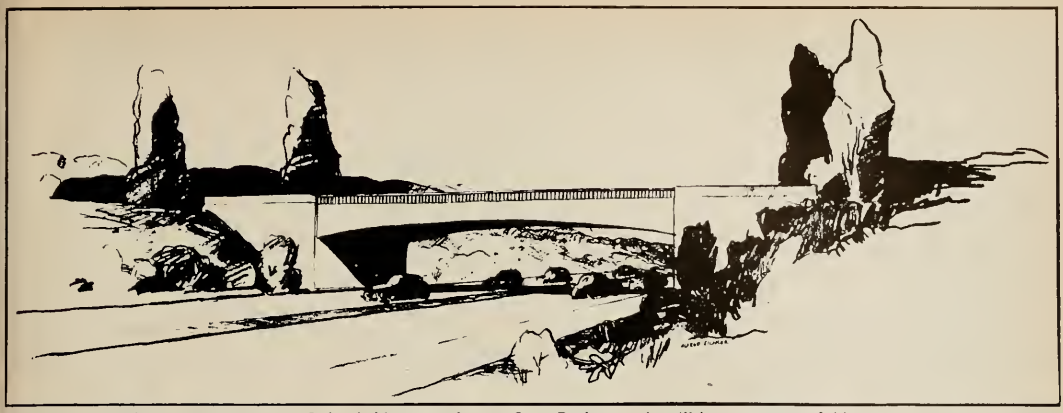
THROUGH ARROYO SECO

Starting at the Figueroa Street Viaduct, which was recently built over the Los Angeles River, the new parkway will follow along the west bank of the Arroyo Seco channel to the boundary line between Los Angeles City and South Pasadena. It will then cross the Arroyo Seco channel and proceed easterly through South Pasadena in a beautified cut and after crossing under Fair Oaks Avenue will turn north and connect with Broadway Street in Pasadena. At a few selected places along the road, one-way side ramps will be built to join the upper roads with the new boulevard.

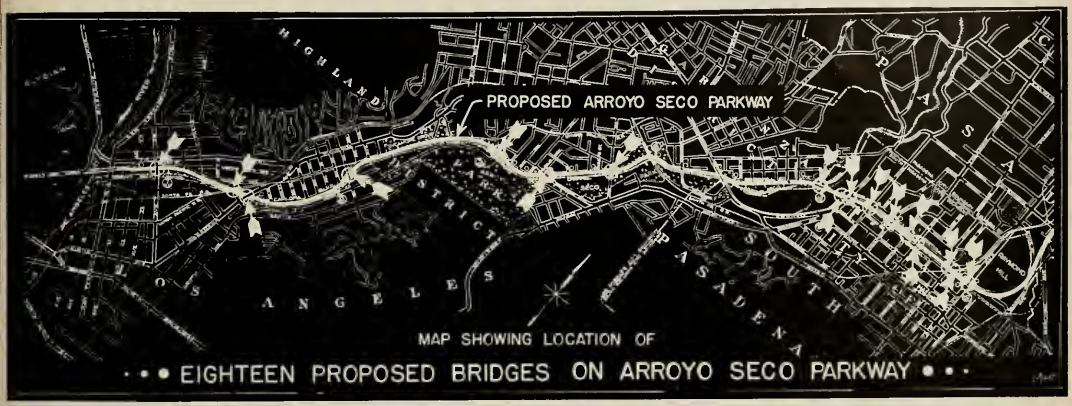
At Avenue 26, Pasadena Avenue, Avenue 43 and Avenue 60 it is proposed to remodel or extend existing bridges so that the new road, which will be a divided highway with thirty-four foot roadway on either side of a central raised curb, may pass beneath.

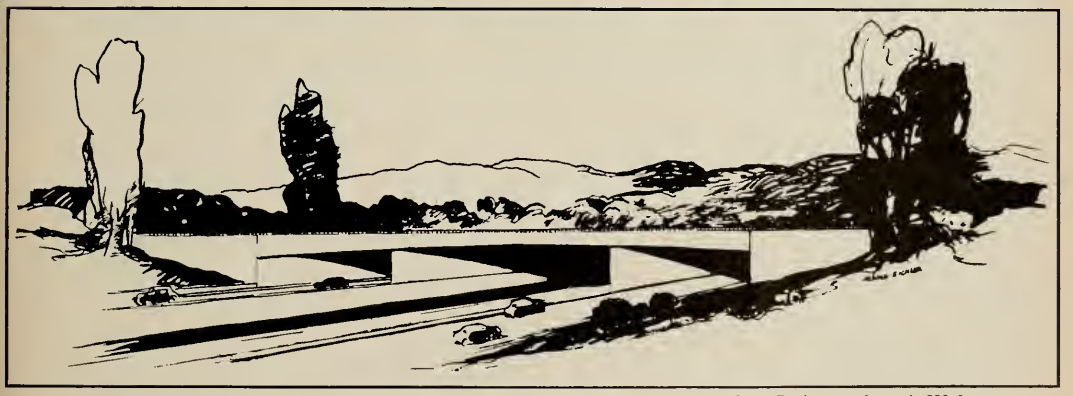
The Union Pacific and Santa Fe bridges immediately west of Pasadena Avenue will also be reconstructed to cross over this highway. At Avenue 52 and Hermon Avenue new bridges will be constructed to cross over the parkway.

Near the boundary line of Los Angeles and South Pasadena a new concrete girder bridge will be built



Sketch of proposed Arroyo Drive bridge over Arroyo Seco Parkway. It will be a concrete rigid span structure.





Proposed continuous concrete span structure carrying Hough Street over Arroyo Seco Parkway. Length 289 feet.

having a central span of one hundred and twenty feet and roadway thirty-four feet wide on each side of a raised central division strip. This is an unusually long span for concrete girder type of construction.

Immediately to the east of this structure there will be a pedestrian and equestrian structure under the

(Continued on page 27)

Broadway Tunnel Opened to Traffic

(Continued from page 4)

In a brief talk, Director of Public Works Earl Lee Kelly pointed out that motorists now may go from the Moraga Valley in Contra Costa County to San Francisco by way of the tunnel and the San Francisco-Oakland Bay Bridge in thirty minutes without exceeding the legal speed limit.

GAS TAX PRESERVED

"Such projects as this," Director Kelly said, "are possible because California's gas tax funds are used solely for highway building and maintenance. One of the finest things Governor Merriam and his administration have done has been the carrying out of a determination to stand fast against any gas tax diversion."

Dneray L. Stewart was master of ceremonies at the West Portal dedication and State Senator T. H. DeLap officiated in a similar capacity at the East Tunnel Portal celebration in Contra Costa County. Among the speakers at the West Portal were W. J. Hamilton, chairman of the Alameda Board of Supervisors; Mayor W. J. McCracken of Oakland, Mayor Edward N. Ament of Berkeley, Dr. L. I. Hewes, U. S. Bureau of Public Roads, Mr. Caldecott, Harry Bell and Edwin W. Geary of the Oakland Junior Chamber of Commerce, and John M. La Dieu, Spanish Pageant narrator.

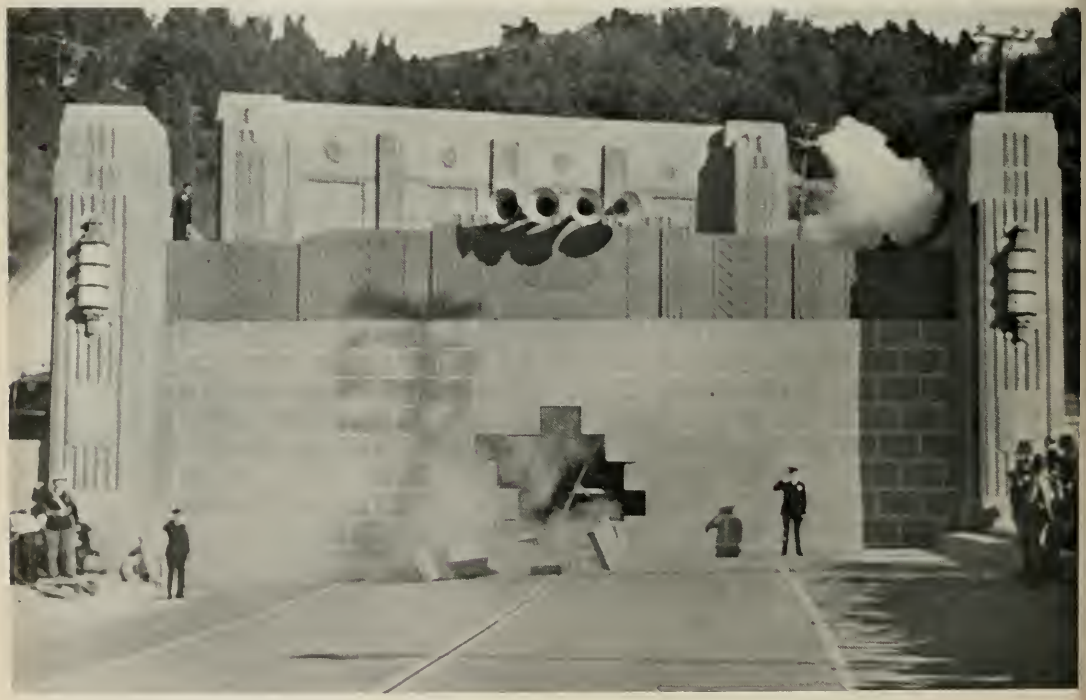
Opening of the West Portal of the bore was spectacularly achieved. From the speakers' stand, Governor Merriam threw a switch which blasted a large hole in a dummy wall blocking entrance to the tunnel and at the same time set off aerial bombs.

HISTORY OF PROJECT

From 1926 to 1928, a joint tunnel commission, composed of members from Contra Costa and Alameda counties and the city of Oakland, was engaged in making preliminary studies for this project.

In 1929 Joint Highway District No. 13, in which Contra Costa and Alameda counties were the participants, was created. George Posey, the father of the Posey Tube between Oakland and Alameda, was appointed district engineer. In 1931 this joint highway district was reorganized under a new law of that year. Upon the death of Mr. Posey in 1932, Wallace B. Boggs succeeded to the position of district engineer, with J. W. Barclay as chief assistant district engineer.

Actual construction work was started with Alameda County relief labor late in 1931, which was carried on into the latter part of the fall of 1932. This construction work was confined to construction of culverts



Photograph taken at instant Governor Merriam blasted aperture in dummy wall blocking West Portal of Broadway Tunnel.

on the Oakland approach highway and the opening up of grading operations. Some preliminary borings and investigation was also performed by this relief labor.

BIDS TAKEN IN 1934

Under the supervision of Mr. Boggs, plans and specifications were prepared and bids were taken on May 22, 1934, for the construction of the complete project. The Six Companies of California, Inc., was the low bidder, at a contract price of $3,683,-931, and received the award of the contract on May 29, 1934. Actual work under this contract was started on June 6, 1934, with a time limit of 720 calendar days, which placed the completion date on May 24, 1936.

On June 13, 1936, the original contract was rescinded by the contractor, with some 68 per cent of the total work completed. The remainder of the work was readvertised under a series of schedules involving various portions of the construction required to complete the project.

CONTRACTS COMPLETED

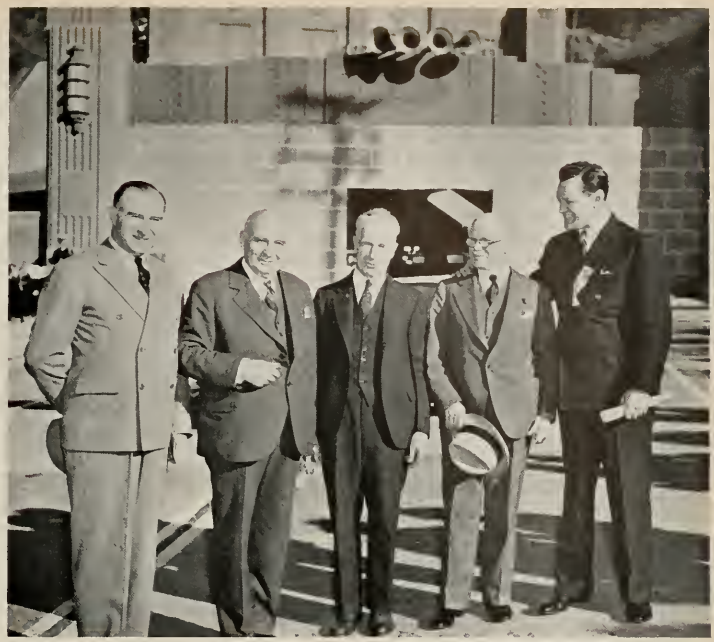
Schedule "A" called for completion of tunnel excavation and concrete arch ring lining. This work was awarded to the George Pollock Company and R. G. Clifford, at a contract price of $731,000. Work under this schedule was started by the contractor on December 9, 1936, and was completed and accepted by the joint highway district on June 22, 1937.

Schedule "B" involved the completion of grouting in the tunnels, and was awarded to R. G. Clifford at a contract price of $29,750. Work under this schedule was started December 21, 1936, and was completed and accepted by the joint highway district on June 22, 1937.

Schedule "C" required the completion of ceilings and roadway in the tunnels. This work was awarded to Fred K. DuPuy at a contract price of $434,886. The contractor started work on February 20, 1937, and completed the paving in the tunnel in time to permit proper curing before the opening date of December 5, 1937.

WORK ON SCHEDULE

Schedule "D" involved the completion of ventilating buildings, which work was awarded to E. T. Lesure at a contract price of $43,460. The contractor started work on February 15, 1937, completing the same just prior to the opening of the project to the public.



These officials express happiness over opening of Broadway Tunnel. Left to right: Earl Lee Kelly, Public Works Director; Governor Frank F. Merriam, Thomas E. Caldecott, President Joint Highway District 13; Dr. L. I. Hewes, U. S. Bureau of Roads; Edwin W. Geary, Oakland Junior Chamber of Commerce.

Schedule "E" covered the completion of ventilation, mechanical and electrical equipment. This work was awarded to the Alta Electric Co. at a contract price of $269,800. Work was started on January 18, 1937, and final tests were made just prior to the opening of the project.

Schedule "F" involved the furnishing and installing of carbon monoxide detectors and recorders, which work was also awarded to the Alta Electric Co. at a contract price of $18,893. Work was started on July 2, 1937, and was completed and accepted by the joint highway district on September 5, 1937.

Schedule "G" involving the completion of highway construction and appurtenant structures was awarded to the Heafy-Moore Company at a contract price of $209,713. Work was started by the contractor on January 15, 1937, and was completed just prior to opening the project.

Schedule "H" called for the completion of steel structures and was awarded to the Berkeley Steel Company at a contract price of $17,360 on April 16, 1937. The work was completed and accepted by the joint highway district on September 18, 1937.

The total cost of the Broadway Low Level Tunnel project, exclusive of the county relief labor employed in 1932, is estimated at $4,173,-000, which amount has been financed by an issue of bonds of the joint highway district, in the amount of $2,378,-000, a 30 per cent Public Works Administration grant of $1,095,000, and a contribution by the State of California of $700,000.

The Broadway Low Level Tunnel project was adequately described in an article by District Engineer Wallace B. Boggs, in the May, 1934, issue of this magazine, at which time were published typical sections of the twin bores, a panoramic sketch showing the complete project, and a plan outline of the tunnel section proper.

In brief resume, the Broadway Low Level Tunnel project, from the junc-

(Continued on page 22)



Sketch on photograph shows proposed Waldo Approach lighting system off northern end of Golden Bate Bridge.

STATE EXPERIMENTS WITH HIGHWAY LIGHTING

By T. H. DENNIS, Maintenance Engineer

HIGHWAY lighting experiments as an accident prevention measure have been undertaken by the State Division of Highways.

The Division is now installing a 3½-mile section of highway lighting on the Bayshore Highway, U. S. 101, between the south city limits of San Francisco and the north city limits of South San Francisco. The standards will be set on staggered spacing, 140 feet apart, the lighting to be sodium vapor with 10,000-lumen lamps.

A second installation, 1½ miles in length, is being made on U. S. 101, between the north end of the Golden Gate Bridge and the crest of grade just north of Waldo Tunnel.

On this section, standards will be placed 125 and 150 feet apart at staggered locations between the bridge and the south end of the Waldo Tunnel, and on a 200-foot staggered spacing from the north end of the tunnel to the crest of the grade beyond. This lighting will also be sodium vapor, the lamps generating 10,000 lumens.

Two types of lighting standards will be used, tapered steel and centrifugally spun concrete. These poles will be thirty feet in length and carry a movable mast arm for suspending the lighting fixture some two feet inside the pavement edge.

The locations were selected not only to provide a proving ground for the efficiency and cost of such lighting, but also because of particular conditions which might justifiably warrant installation.

While these installations will mark our first strictly highway lighting experiments as an accident prevention move on the open highway, we have, during the past two years, made some 34 sodium vapor installations at underpasses and highway intersections.

POLICY AT INTERSECTIONS

The locations selected in all cases conformed to the following policy:

1. **Intersections which, from their design and location, presented an element of surprise to the approaching driver, and a hazard if he stopped.**
2. **Intersections where it was necessary to place "Stop" signs against the heavier traffic, especially at "Y" intersections.**
3. **At cross intersections, where it was found necessary to place four-way "Stop" signs.**



It has been the practice of the Division of Highways to compile and analyze accident records on the various sections of highway for the past eight years. On the entire section of the Bayshore Highway between San Jose and San Francisco, only that portion between South San Francisco and San Francisco shows a type of accident which, if such is possible, might be eliminated by highway lighting.

FOG HAZARDS INVOLVED

On the section selected for lighting north of the Golden Gate Bridge, the normal hazards of nightly fogs are complicated by the highly-lighted bridge structure, as well as that of the Waldo Tunnel. Traffic emerging from either the bridge or the tunnel is often confronted with a dense fog, which will likely tend to accidents.

There can be no doubt that the hazard of accident on the rural State highways, measured in terms of vehicle miles traveled, is much greater at night than during the daylight hours. It should be noted, however, that there are very few, if any, types of night accidents which do not also occur during daylight.

We may, and in fact do, find increased frequency of certain types of accidents during darkness, but none which would automatically disappear if daylight were continuous throughout the twenty-four hours.

(Continued on page 27)



Upper picture shows projected lighting system to protect traffic emerging from southern portal of Waldo Tunnel. Lower—Lighting system for Marin approach to Golden Gate Bridge.

Contra Costa Unit of Central Valley Project is Launched

AN IMPORTANT milestone in the march toward realization of the Central Valley Project was reached in October when the construction of the Contra Costa Conduit unit of the project got actively under way.

This highly significant event, marking as it does the actual beginning of construction work on the project itself, was the occasion for an enthusiastic celebration held on November 7, 1937, under the auspices of the Contra Costa County Development Association.

Nearly a thousand people comprising representative citizens, officials, and distinguished guests from all sections of northern California, gathered on the site of the conduit near Oakley to witness and participate in ground-breaking ceremonies.

With Thomas M. Carlson, attorney for the Contra Costa County Water District acting as master of ceremonies, eminent officials and civic leaders, long active in support and advancement of the Central Valley Project, addressed the gathering.

EMINENT SPEAKERS

These included State Senator Will R. Sharkey, president of the Contra Costa County Development Association; former Assemblyman Robert P. Easley of Antioch; Chairman W. J. Buchanan of the Contra Costa County Board of Supervisors; President C. W. Schedler, of the Salt Water Barrier Association which pioneered water plans for the County; President Ralph Bollman, of the Contra Costa County Water District; former Assemblyman Clifford C. Anglim, chairman of the State Democratic Central Committee; State Senator Bradford S. Crittenden of Stockton; Clarence Breuner and John McColl, president and manager respectively of the Central Valley Project Association; Keith Southard, representative of the Golden Gate International Exposition Committee; Fred D. Parr of the Parr-Richmond Terminal Corporation; Construction Engineer Walker R. Young, in charge of the project for the United States Bureau of Reclamation; Congressman Albert E. Carter who introduced and led the fight for adoption of legislation authorizing the project as a Federal undertaking at the last session of Congress; United States Senator Ernest Lundeen, a surprise visitor and honored guest from Minnesota; and Governor Frank F. Merriam who officiated at the ground-breaking ceremonies.

TELL OF LONG FIGHT

Recounting the long drawn out battle to obtain additional water supplies to meet serious existing water shortages in Contra Costa County and in the Sacramento and San Joaquin valleys, which culminated in the adoption of legislation by both the State and Federal Governments authorizing the Central Valley Project and providing for its construction, speakers joined in praising all those who had a part in bringing the project to the stage of actual construction.

With cheers resounding from the entire assemblage, Governor Merriam gave the "okeh" signal to the giant dragline excavator and the first bucket load of earth was moved, officially signalizing the starting of work.

GOVERNOR SPEAKS

"This marks the official beginning of a project for which all California has been waiting," said Governor Merriam. "It is the first real throwing of dirt on the project, but it is only the beginning. We must now look forward to succeeding years, when this great project is completed, to give us a greater California.

"The Central Valley Project is one of the greatest undertakings of its kind the world has ever known, and the people of the State realize its vital need. There is sufficient water tributary to the Great Central Valley to meet every need, if conserved and properly distributed. This the Central Valley Project will do. The project has now emerged from the stage of prospecting and estimating to the reality of construction."

The Contra Costa Conduit is a minor but nevertheless important unit of the Central Valley Project. Diverting from an arm of the Delta near Knightsen, it will extend westerly a distance of forty-five miles to the vicinity of Martinez.

Present plans contemplate an open concrete-lined canal with four pumping plants to lift the water in successive stages through an aggregate lift of 130 feet. When completed, it will furnish water for industrial, municipal, domestic and irrigation purposes to an area of about 60,000 areas in Contra Costa County, bordering the lower San Joaquin River and south shore of Suisun Bay from Oakley on the east to Martinez on the west and embracing lands in the Clayton and Ignacio valleys as far south as Walnut Creek. It will serve one of the most highly developed industrial sections in the State, several important cities, such as Antioch, Pittsburg, Concord, and Martiuez, extensive suburban developments, and productive agricultural lands already largely developed to orchards and vineyards.

Serious water shortages which now exist in this area will be fully met with the bringing in of ample quantities of fresh water through this conduit.

The work now under way comprises the first four miles of conduit. Although the contract was let early last summer, start of work was delayed due to difficulties in acquiring necessary rights of way. The present contract covers excavation and necessary structures for a section of unlined canal extending from the westerly end of Rock Slough to the first pumping plant site near Oakley. It is expected that bids will soon be advertised for an additional eight mile section. The entire conduit is estimated to cost, when completed, about $4,000,000.

Fortune Teller (to bride of a few months): "You wish to know about your future husband?"

Bride: "No; I wish to know about the past of my present husband for future use."







Scenes at ceremonies attending start of operations on Contra Costa Conduit, a unit of Central Valley Project. Upper picture shows group of officials present. Left to right: State Senator Bradford Crittenden, Robt. P. Easley, Thomas M. Carlson, W. R. Sharkey, Congressman A. E. Carter, Governor Frank F. Merriam, U. S. Senator Ernest Lundeen, Minnesota; Cliff Anglin, W. J. Buchanan, chairman Contra Costa Supervisors. Lower left—Steam shovel digs up first load of earth and on right dumps it, signalizing start of work on project. *Photos courtesy Oakland Tribune.*

Hazard of Curves on Highway To Placerville Being Removed

By SCOTT H. LATHROP, Assistant Engineer

MOTORISTS who are familiar with the State highway between Sacramento and Placerville will be glad to learn that construction now under way southwest of Placerville will shorten this route by 1.9 miles and eliminate many of the dangerous short radius curves so prevalent on the present road.

This highway passes through one of the most historic sections of the State, for it was near Coloma in El Dorado County that John Marshall's dramatic discovery of gold was made and such names as Hangtown, Mud Springs, Diamond Springs, Shingle Springs, and Missouri Flat soon became bywords in every part of the world where the great gold rush to California was discussed. Hangtown, which was previously known as "Old Dry Diggin's," later became Placerville and Mud Springs refined its name to El Dorado.

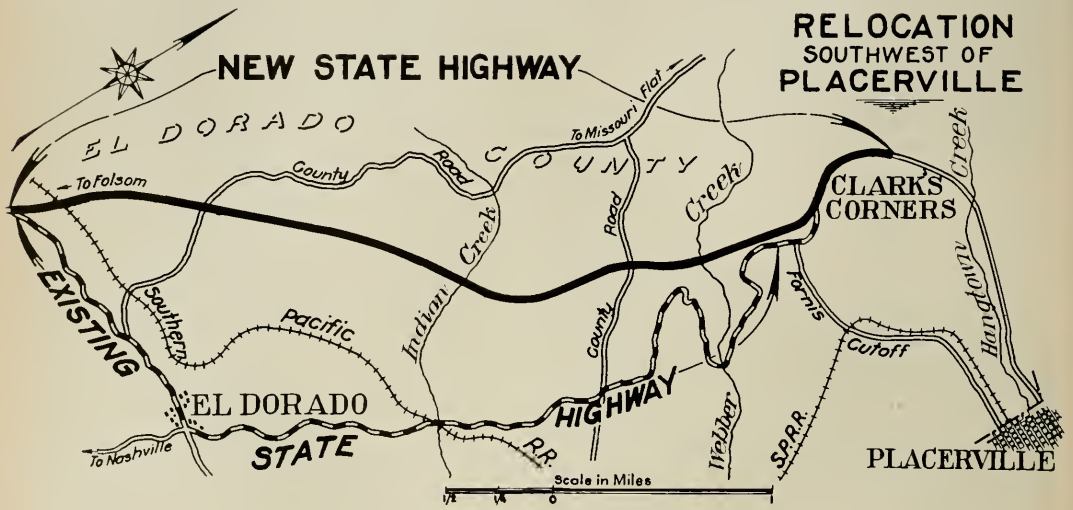
The main route, from the east, to Coloma and the gold diggings in 1849 and the early '50's was the Carson Emigrant Road which came through the Sierras by way of the Kit Carson Pass. This pass was some 9000 feet above sea level but was used by the early pioneers because they feared that other passes, while they were lower, had sharper hills and deeper gulches. As travel through the Sierras increased some of the hardier souls began to prospect around for easier routes and shortcuts which would save them time, with the result that several alternate routes were developed and more or less widely used.

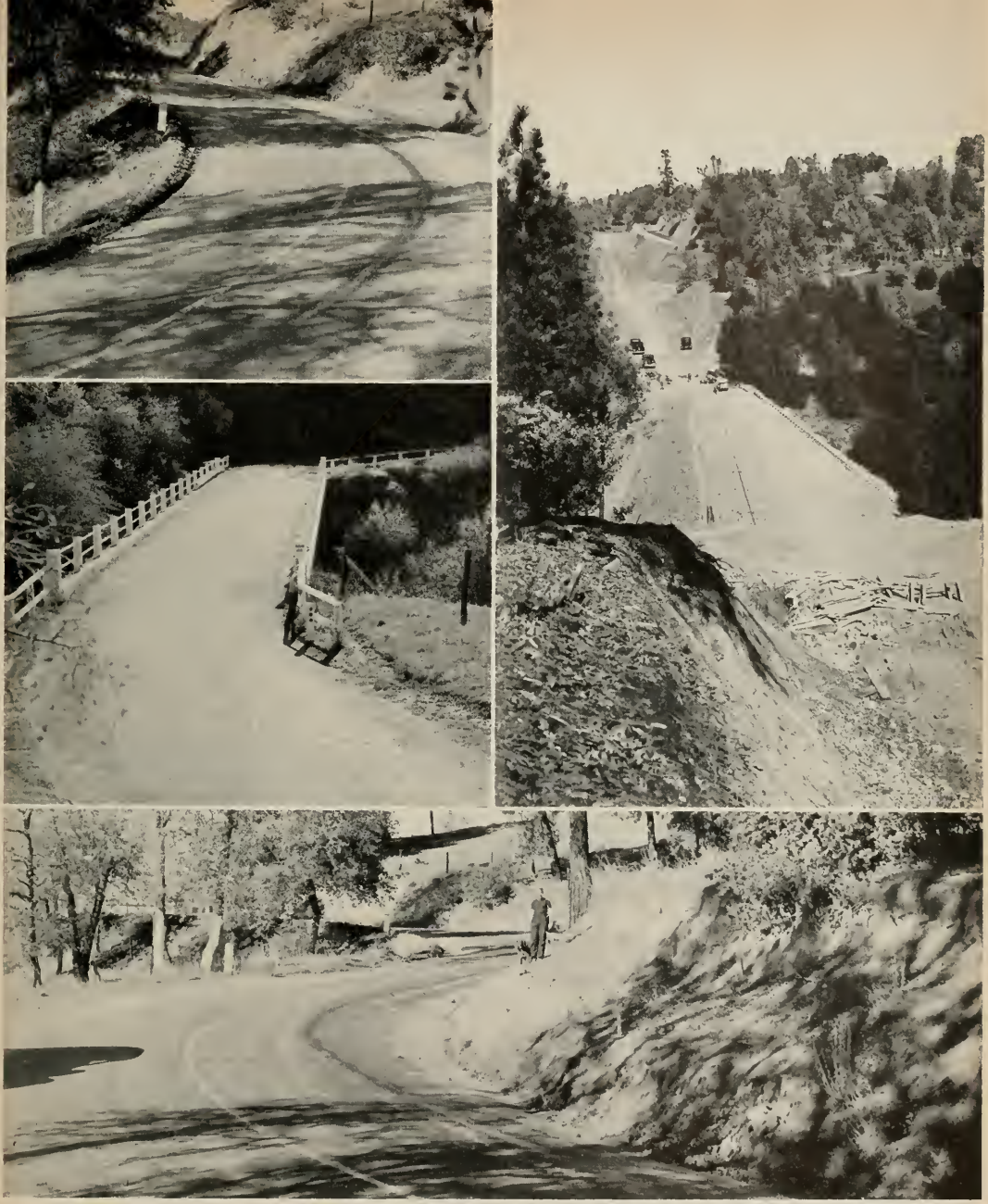
The most popular of these shorter routes was what was known as Johnson's Cut-off, which was later called the Placerville Road. This route was first made passable for wagons in 1854 and organized construction work was begun in 1858, after El Dorado, Sacramento, and Yolo counties had appropriated $50,000 for this purpose.

Stages and mail coaches began to operate over the road even before grading and leveling was started, thus proving the feasibility of this shorter, lower route. State and county governments became apathetic toward the project, however, and it is probable that it would have been abandoned and the Placerville Road through the Sierra would have became impassable had it not been for the discovery of rich silver deposits in the Comstock Lode in Nevada.

As soon as news of this discovery was confirmed private companies scrambled to obtain charters to establish toll roads and huge sums were invested by them in completing sections of this road east of Placerville. All of these companies soon cleared enough to retire their investments and many of them made large fortunes.

It has been estimated that during the years of 1864 and 1865 the daily freight traffic through Placerville averaged 320 tons. In addition to the cumbersome freight schooners this route served as a main traffic artery for mule trains, Concord coaches, and





On Placerville project. Upper left—Old alignment between Webber Creek bridge and Clark's Corner. Center left—Webber Creek bridge, to be replaced. Upper right—Realignment across site of new Webber Creek bridge. Lower—One of sharp curves between Clark's Corner and El Dorado to be eliminated. Distance will be shortened almost two miles and short radius curves abolished on this historic highway.

Pony Express riders during the early California pioneer days.

Since the road was taken over by the State, improvements have been made as needed to keep the road in shape to serve the changing types of traffic. The advent of the automobile required the provision of a hard surface and, as driving speeds increased, it became necessary to improve the alignment and grades in the interest of public safety.

The present road is a part of U. S. Route 50, which is one of the main east-west transcontinental roads. In addition to serving a large number of through tourists each year and caring for considerable volumes of local traffic, this route is serving an increasing number of persons traveling to and from recreational areas located along the American River and the south end of Lake Tahoe.

ELIMINATE CURVES

The Folsom to Placerville section of this road was constructed in 1915, the pavement width being only 12 feet, to which borders were subsequently added. The alignment was satisfactory at that time but the short radius curves used make it practically impossible to maintain what is now considered to be a reasonable speed. Reconstruction of this section will be undertaken as funds become available.

The first unit of this construction, on which work is now under way, is located southwest of Placerville between El Dorado and Clark's Corner. The new construction is principally on new alignment at some distance from the old road and is about 1.9 miles shorter than the old route, the total length of the new project being 4.3 miles.

The minimum radius of curvature on the new alignment is 3000 feet, except for one 1550-foot curve and one 1000-foot curve, which were necessitated by local controls. On the old road there are many more curves, the majority of which have very short radii, many of them 100 feet or less. In order to obtain satisfactory standards of grade and alignment, roadway excavation of some 50,000 cubic yards a mile was required. In addition to the customary drainage structures it was necessary to provide for several crossings of the old Missouri Flat ditch.

The new highway crosses Webber Creek about three-quarters of the way through the project. The adopted grade line at the crossing of this creek, at a considerable height above streambed, required a bridge 322 feet in length. This bridge, which will provide a clear roadway width of 26 feet, will be of the reinforced concrete girder type, having three 71-foot spans and two 54-foot 6-inch spans on concrete bents and abutments. This bridge is being built under a separate contract.

The contractor has already completed most of the grading work on the road contract. Work will be suspended during the winter months and surfacing operations are to be started as soon as weather conditions permit in 1938. The surfacing will consist of plant-mixed bituminous treated crushed rock 22 feet wide by 0.25 of a foot thick on a crusher run base 23 feet wide by 0.4 of a foot thick. It is estimated that the entire project will be completed and public traffic routed over it in July of next year.

The estimated cost of the grading and surfacing is $190,000, with the Webber Creek Bridge estimated to cost an additional $41,000. Hemstreet and Bell are the contractors on the highway project, with Mr. J. D. Greene acting as resident engineer for the State. On the bridge construction the contractor is the Campbell Construction Company and the resident engineer is Mr. J. H. Horn.

U. S. Begins Study of Kings River Project

John R. Iakisch, United States Bureau of Reclamation Engineer, has begun a study of the proposed Kings River Project in Fresno, Kings and Tulare counties, which is listed by the State of California as a unit of the comprehensive state-wide Water Plan, a long-range program for the ultimate development of California's water resources.

The report to be filed by Mr. Iakisch will be of interest to the California Basin Committees, recently appointed by Governor Frank F. Merriam to recommend to President Roosevelt through the National Resources committee various water, irrigation and reclamation projects in this State which urgently require Federal aid.

Before going to Fresno to undertake his survey, Mr. Iakisch together with Walker R. Young, construction engineer of the Central Valley Project, conferred in Sacramento with State Engineer Edward Hyatt.

Port of Oakland Overhead Work Now Under Way

RAPID progress is being made in the construction of the Port of Oakland overhead highway and the electric interurban overheads on the eastern approach to the San Francisco-Oakland Bay Bridge, a $450,000 project being built under authorization of the California Toll Bridge Authority, of which Governor Frank F. Merriam is chairman.

Contracts for the building of the Port of Oakland overhead highway, transbay train overhead, catenary bridges and other work on the storage yards approximate $1,222,000. The job is being done by the Department of Public Works. C. H. Purcell is Chief Engineer.

The highway overhead will cross above the Southern Pacific and Key Route interurban electric trains in the East Bay yards and will connect with the direct four-lane East Bay highway approach to the Bay Bridge.

TWO-LANE RAMPS

Two-lane "On" and "Off" ramps will permit traffic to enter and leave the main bridge approach without intersecting traffic.

The total width of the Port of Oakland approach is 42 feet, with 22-foot "On" and "Off" ramps.

Port of Oakland is constructing the highway connecting with the overhead and the Port. The project will be lighted by sodium vapor luminaires, similar to those used on the Bay Bridge.

FOR AUTOS AND TRUCKS

The highway overhead will carry automobile and truck traffic in four lanes over the bridge railway system, separating in two "On" and "Off" ramps at the main bridge highway approach east of the Bay Bridge toll plaza.

Interurban Southern Pacific electric trains will be routed over an overhead "Y" structure at the end of 26th Street. From this structure Oakland and Alameda trains will proceed south through the 16th Street station. Berkeley trains will be routed north from the "Y."

Trains are scheduled to start operating over the Bay Bridge in November, 1938.





Upper drawing on aerial photo shows East Bay electric railway approaches to Bay Bridge. Key Route trains will proceed through subway. Southern Pacific trains will be routed overhead at end of 26th Street. Lower—Section of Port of Oakland overhead with Bay Bridge and its Toll Plaza in distance. Overhead will connect with bridge highway by ramps as shown in lower picture.

Broadway Low Level Tunnel is Open

(Continued from page 13)

tion of the Oakland approach with Broadway to the east portal junction with State Highway Route 75 in Contra Costa County, is 2.8 miles in length. This project replaces a number of circuitous routes from various sections of Oakland and Berkeley, crossing the backbone of the hills between Alameda and Contra Costa counties at a summit elevation of 1300 feet, using the "Fish Ranch Road," or a 1040 foot length timber tunnel, 17 feet clear width between sidewall timbers, at a summit elevation of 1045 feet connecting with the Skyline Boulevard.

The new tunnel will afford savings in distance of from .2 mile from Berkeley to 1.2 miles from downtown Oakland, using the Fish Ranch Road, and 1.9 miles from Oakland via the Skyline Boulevard and original tunnel.

The elevation of the new tunnel is approximately 750 feet at the west portal and about 130 feet higher at the east portal, which places it from 160 to 290 feet below the original narrow two-lane tunnel.

CURVES ELIMINATED

The minimum radius curve on the new project is 800 feet, the new alignment representing a saving of some ten complete circle-turns between Oakland and Contra Costa counties via the original tunnel.

The Oakland approach is 1.9 miles in length, with pavement constructed forty feet in width, with ten-foot shoulders on either side. Three highway grade separations have been constructed on this approach, with a clear roadway width of 44 feet between curbs. One of these three structures is combined with an overhead crossing over the Sacramento-Northern electric railroad.

The tunnel project also includes a highway connection to Berkeley (State Highway Route 206) leading to Ashby Avenue. This connection, by means of the Landvale overhead, also extends approximately one-half mile southeasterly of Route 75 to a connection with Oakland's Mountain Boulevard. This one-half mile connection is not a portion of the State Highway System, but was included in the joint highway district project.

Commendation

SAN FRANCISCO PUBLIC SCHOOLS

Office of the Superintendent
Civic Auditorium
San Francisco

November 26, 1937.

Editor,

California Highway and
Public Works,
Sacramento, California.

Dear Sir:

For the past several months I have been reading and admiring successive editions of California Highways and Public Works. After reading the November issue, I succumb to the temptation to tell you that your magazine is without doubt the most inviting, the best edited, and gives a more complete view of activities throughout the state than any other publication which comes to my desk. The magazine has a high educational value and gives a true reflection of the great strides which are being made almost daily in the improvement and maintenance of California's highway system. Will you please continue my name on the mailing list?

Very truly yours,
(Signed) George F. Mullany,
Director of Publications.

TWIN BORES

At the east portal building of the tunnel in Contra Costa County, separation of grades in a connection with the Fish Ranch Road is accomplished as a portion of the building and portal structure.

The twin bores of the tunnel proper consists each of a 22-foot clear roadway between curbs, with a three-foot sidewalk on one side, 26-foot 8-inch clearance wall to wall, with a 15-foot 8-inch ceiling height. The inner walls of the two bores are separated approximately 15 feet at the two portals, but diverge to a maximum of about 100 feet under the crest of the mountain. The total covered length of the east-bound bore is 3203, and that of the west-bound bore, 3135 feet.

Easy light transition is provided by the construction of an overhead louver section, supported upon the portal approach walls, about 200 feet in length at either end.

These overhead louvers prevent direct rays of sunlight from falling upon the roadway area, and provide a lighting of intermediate intensity between the direct sunlight outside and the artificial illumination inside the tunnel bores.

The illumination within the tunnel proper is by means of incandescent lights, the reflectors of which are opaque for the rear half of the globe and clear glass in front, which projects the light ahead of the driver and provides an indirect lighting effect which is very efficient and eliminates all glare.

T. E. Ferneau was asigned as the State's Resident Engineer on this project in June, 1934, remaining on same until the original contract was rescinded in June of 1936, at which time he was assigned to another important construction project. R. J. Ivy was the State's Resident Engineer on the remainder of this construction project to the date of completion.

F. I. Doane has been assigned as engineer in charge of maintenance and operation of this project.

Auto Has Second Place On Western Family's Budget

Automobiles give precedence only to food in the budgets of many families in the extreme western part of the United States, according to statistics of the United States Department of Agriculture.

A survey conducted in 24 Pacific Coast towns revealed that in the very lowest income groups, families spend more for food and housing, and sometimes more for clothing than for automobiles, but as soon as a family attains an income of $1000 to $1500 the automobile takes second place on the budget after food.



This picture shows the laying of ties for the San Francisco-Oakland Bay Bridge railway system at easterly edge of span.

FIRST RAILWAY TIE IS LAID ON BAY BRIDGE

THE first of 105,000 ties for the $17,000,000 railway system of the San Francisco-Oakland Bay Bridge was laid on the morning of November 29 on the bridge proper.

Operating from a specially designed machine, the tie was neatly slipped into place by Bridge Engineer Charles E. Andrew at a point in Span E-22 on the easterly end of the structure.

The bridge proper will have 50,000 redwood ties, 8 inches by 9 inches thick and varying in length from 9 to 15 feet. Each tie is marked for its own position on the rail deck.

The ties will be placed directly on the steel stringers, which have been prepared with two coats of a coal tar paint. Before placing, the ties will have been "dapped" or notched at each end, with the cuts 6 feet, 6 inches apart, and at depths varying from a quarter-inch to an inch and a quarter and averaging a width of 11 inches. The tie will thus be slipped into its specified place on the stringer. The depth of the dap or notch depends on the location of the ties, which are placed in consecutive order according to number. This schedule assures a smooth running roadbed.

Selection of redwood for ties, Mr. Andrew pointed out, was due to its minimum conductivity of electricity, an essential requisite in the case of the Bay Bridge railway system, which cannot afford waste of current in connection with its elaborate signal system.



Bridge Engineer C. E. Andrew places first railway tie in position on Bay Bridge.

Maintenance Men Discuss Their Highway Problems



ON NOVEMBER 22 and 23, ninety-seven members of the Maintenance Department of the State Division of Highways met at Sacramento for a discussion of problems connected with the highway maintenance work.

The Maintenance Engineer and his staff, the District Maintenance Engineers with their assistants, and the Maintenance Superintendents—with one exception—were in attendance.

Earl Lee Kelly, Director of Public Works, talked to the meeting on Monday and stayed for part of the program. G. T. McCoy, Assistant State Highway Engineer; J. G. Standley, Principal Assistant Engineer; and several of the heads of departments, as well as representatives from the Bridge and Legal Departments, also attended and entered into the discussions.

Ray Duffy, District Maintenance Engineer, District IV, San Francisco, acted as chairman of the day for the Monday meeting, and Joe Stanton, District Maintenance Engineer, District VIII, San Bernardino, for the Tuesday meeting. The program was prepared from subjects submitted by these two men after contacting the other districts. It was planned primarily for discussion of problems from the field man's point of view. No formal papers had been prepared.

There is no question but that everyone in attendance secured benefit, not only from the discussion throughout the two days, but also from contact with men from other Districts, as well as the opportunity to see the type of work in other Districts which the trip to and from Sacramento afforded.

D. D. Breuning, Maintenance Superintendent of Woodland was unable to attend on account of illness.

Those in attendanee at the sessions were:

CENTRAL OFFICE, SACRAMENTO.

T. H. Dennis, Maintenance Engineer. Assistant Maintenance Engineers W. A. Smith, C. F. Woodin, N. R. Bangert, P. L. Fite, R. B. Millard, F. M. Carter (Signing), K. A. MacLachlan (Planning Survey), H. L. Kile (Accident Studies). J. M. Call, Outdoor Advertising. E. S. Whitaker, Assistant Landscape Engineer. C. S. T. Marckhoff, Maintenance Superintendent (Bridge Painting Crew).

District I, Eureka. E. M. Cameron, District Maintenance Engineer. F. L. Meyer, Assistant to District Maintenance Engineer. C. H. Amesbury, Assistant District Maintenance Engineer. Maintenance Superintendents J. A. Brown, C. H. Sackett, C. A. Miller, G. W. Lane, W. H. Miller, Guy McMurtry.

District II, Redding. H. B. LaForge, District Maintenance Engineer. L. C. Evans, Assistant to District Maintenance Engineer. Maintenance Superintendents R. L. Hollis, L. D. Craig, J. H. Rust, F. C. Macaulay, G. H. Nutting, E. L. Stump, E. J. Gribble.

District III, Marysville. J. L. Piper, District Maintenance Engineer. C. E. Thompson, Assistant to District Maintenance Engineer. Maintenance Superintendents H. T. Bigelow, F. R. Garrison, O. F. Georges, C. W. Rust, C. H. Weeks, E. D. Willis.

District IV, San Francisco. R. P. Duffy, District Maintenance Engineer. R. A. Wilson, Assistant District Maintenance Engineer. Maintenance Superintendents J. W. Adams, R. K. Forrest, W. F. Holbrook, A. S. Moore, L. T. Robinson.

District V, San Luis Obispo. H. L. Cooper, District Maintenance Engineer. W. S. Dolliver, Assistant District Maintenance Engineer. Maintenance Superintendents T. M. Joyce, R. S. Peck, K. Mendenhall, C. F. Toole.

District VI, Fresno. E. E. Evers, District Maintenance Engineer. Assistant District Maintenance Engineers Tom Eastman and Earle W. Taylor. Maintenance Superintendents B. W. Latour, Carl Nelson, L. W. Seymour, J. F. Clarke, S. T. Myers, C. F. Johnson.

District VII, Los Angeles. E. T. Scott, District Maintenance Engineer. Assistant District Maintenance Engineers Wm. L. Fahey and D. H. Greeley. Maintenance Superintendents G. H. Cheeseman, B. M. Gallagher, T. W. Martin, C. T. Warren.

District VIII, San Bernardino. J. E. Stanton, District Maintenance Engineer. L. Norlen, Assistant District Maintenance Engineer. Maintenance Superintendents Ben R. Bond, M. J. Small, C. L. Caine. J. B. Davidson, E. M. Maurer, B. A. Switzer.

District IX, Bishop. C. Cleman, District Maintenance Engineer. W. M. Reith. Assistant District Maintenance Engineer. Maintenance Superintendents Grant Merrill. Dwight Wonacott, Joseph Lemos.

District X, Stockton. C. E. Bovey, District Maintenance Engineer. Assistant District Maintenance Engineers A. I. Rivett and W. D. Sedgwick. Maintenance Superintendents H. S. Clark, J. H. Gates, L. H. Haigh, S. E. Harris, L. H. Kahl, W. H. Martin, B. M. Mehl, S. Sawyer.

District XI, San Diego. H. S. Comly, District Maintenance Engineer. R. B. Luckenbach, Assistant District Maintenance Engineer. Maintenance Superintendents Chas. Harbey, E. A. Wolfe, I. A. Thomas, Morris Mitchell.

Highway Bids and Awards for November, 1937

HUMBOLDT COUNTY—Between Stegemeyer Bluffs and Myers, about 2.9 miles to be graded and surfaced with plant-mixed surfacing and Class "B" seal coat to be applied to the full width of roadbed. District I, Route 1, Sections B, C. Macco Construction Co., Clearwater, $288,955; Parker-Schram Co., Portland, Oregon, $275,240; Union Paving Co., San Francisco, $261,210; Piombo Bros. and Co., San Francisco, $236,677; Poulos and McEwen, Sacramento, $232,635; N. M. Ball Sons and D. McDonald, Berkeley, $232,549; Fredericksen and Westbrook, Lower Lake, $233,155. Contract awarded to Hemstreet and Bell, Marysville, $226,636.

INYO COUNTY—Grading and penetration oil treatment, 17 miles southeast of Keeler, 0.7 mile in length. District IX, Route 127, Section E. Rexroth and Rexroth, Bakersfield, $7,086; T. G. Smith, Huntington Park, $6,136; Basich Bros., Torrance, $4,704. Contract awarded to A. S. Vinnell Co., Alhambra, $4,435.90.

LOS ANGELES COUNTY—Between Valley Blvd., and Las Tunas Drive, about 1.2 miles to be graded and paved with Portland cement concrete and plant-mixed surfacing. District VII, Route 168, Section C. Dimmitt and Taylor, Los Angeles, $80,566; Southern California Roads Co., Los Angeles, $78,852; Daley Corp., San Diego, $79,285; W. E. Hall Co., Alhambra, $73,785; Claude Fisher Co., Ltd., Los Angeles, $73,622; E. Paul Ford, San Diego, $71,681; Oswald Bros., Los Angeles, $71,294; C. O. Sparks and Mundo Engineering Co., Los Angeles, $74,624; George R. Curtis Paving Co., Los Angeles, $69,908; Griffith Company, Los Angeles, $69,967; United Concrete Pipe Corp., Los Angeles, $81,487. Contract awarded to J. E. Haddock, Ltd., Pasadena, $67,918.80.

LOS ANGELES COUNTY—Bridges across Zuma Creek and Trancas Creek at points about 17 and 18 miles north of Santa Monica, to be widened. District VII, Route 60, Section A. Dimmit and Taylor, Los Angeles, $52,065; Oscar Oberg, Los Angeles, $40,764; Andy Sordal, Long Beach, $43,067; Carlo Bongiovanni, Los Angeles, $44,999; Byerts and Dunn, Los Angeles, $45,424; C. O. Sparks and Mundo Engineering Co., Los Angeles $47,870; Contracting Engineers Co., Los Angeles, $56,850; J. E. Haddock, Ltd., Pasadena, $41,631; Case Construction Co., Inc., Alhambra, $41,745; J. S. Metzger and Son, Los Angeles, $39,188. Contract awarded to John Strona, Pomona, $34,743.80.

LOS ANGELES COUNTY—On Puente Avenue at Walnut Creek, a reinforced concrete girder bridge to be constructed and about 0.3 mile of approach roadway to be graded and surfaced with plant-mixed surfacing. District VII, Route 170, Section B. Dimmitt and Taylor, Los Angeles, $17,562; Griffith Company, Los Angeles, $19,764; Oswald Bros., Los Angeles, $17,962; Vido Kovacevich, South Gate, $19,666. Contract awarded to Claude Fisher Co., Ltd., Los Angeles, $15,698.

MENDOCINO COUNTY—Between Albion and Newport, about 1.6 miles to be graded. District I, Route 56, Sections D, F. N. M. Ball Sons, Berkeley, $32,082; Parish Bros., Los Angeles, $38,824; John Rocca, San Rafael, $49,722; Guerin Bros., San Francisco, $29,317; Claude C. Wood, Stockton, $41,954; Chas. L. Harney, San Francisco, $39,530; John Burman and Sons, Eureka, $33,754; Young and Son Company, Ltd., Berkeley, $27,906; Helwig Construction Co., Sebastopol, $43,290. Contract awarded to A. R. Maestretti, Stockton, $27,245.

MENDOCINO COUNTY—A reinforced concrete bridge across Jughandle Creek about 5 miles south of Fort Bragg, consisting of 16 slab spans having a total length of 388 feet supported by an open spandrel arch and concrete bents, and about 0.3 mile of roadway to be graded and treated with asphalt. District I, Route 56, Section E. F. J. Maurer and Son, Inc., Eureka, $65,419; C. W. Caletti and Co., San Rafael, $71,185; S. D. Bechtel, San Francisco, $79,025; Mercer, Fraser Company, Eureka, $84,730; A. Soda and Son, Oakland, $89,476. Contract awarded to John Rocca, San Rafael, $55,046.90.

MENDOCINO COUNTY—About 15 miles north of Point Arena across Elk Creek, a reinforced concrete girder bridge to be constructed, consisting of one 50-foot span and two 35-foot spans on concrete piers and abutments with pile foundations, about 0.30 miles of roadway to be graded and a penetration oil treatment applied. District I, Route 56, Section C. Peter J. McHugh, San Francisco, $33,161; John Rocca, San Rafael, $36,100; C. W. Caletti and Co., San Rafael, $38,174; Valley Construction Co., San Jose, $38,365; A. Soda and Son, Oakland, $42,113; Mercer, Fraser Co., Eureka, $42,502. Contract awarded to F. J. Maurer and Son, Inc., Eureka, $33,046.50.

ORANGE COUNTY—Tustin Avenue at 17th Street, about 0.5 mile to be graded and paved with asphalt concrete and plant-mixed surfacing. District VII, Route 43, Section A. Sully-Miller Contracting Co., Long Beach, $19,118; G. O. Gartz, Los Angeles, $27,021; Griffith Co., Los Angeles, $23,192; Oswald Bros., Los Angeles, $21,653. Contract awarded to C. O. Sparks and Mundo Engineering Co., Los Angeles, $18,852.75.

RIVERSIDE COUNTY—Between two miles south of San Bernardino County line and Beaumont, about 2.4 miles to be graded and paved with plant-mixed surfacing. District VIII, Route 26, Section A. Dimmitt and Taylor, Los Angeles, $77,185; George Hertz & Co., San Bernardino, $75,654; Claude Fisher Co., Ltd., Los Angeles, $78,176; C. O. Sparks and Mundo Engineering Co., Los Angeles, $73,904; Crow Brothers Construction Co., Los Angeles, $74,329; Griffith Co., Los Angeles, $72,845; A. S. Vinnell Co., Alhambra, $90,379. Contract awarded to Oswald Brothers, Los Angeles, $65,899.00.

SAN DIEGO COUNTY—Timber bridge and approaches to be constructed at San Felipe Creek, 11.8 miles east of Julian, District XI, Route 198, Sections E, F. R. E. Hazard and Sons, San Diego, $16,295; Valley Construction Co., San Jose, $19,287; W. R. Shriver, Los Angeles, $20,039; B. G. Carroll, San Diego, $16,724. Contract awarded to V. R. Dennis Construction Co., San Diego, $14,205.30.

SACRAMENTO COUNTY—Across Cosumnes River near Live Oak, existing bridge to be redecked with Portland cement concrete and plant-mixed surfacing. District III, Route 54, Section C. John C. O'Leary Construction Co., San Francisco, $12,457; Holdener Construction Co., Sacramento, $10,913; Tieslan Bros., Berkeley, $12,280; M. A. Jenkins, Sacramento, $7,390. Contract awarded to Lord and Bishop, Sacramento, $7,196.

SAN JOAQUIN-SACRAMENTO COUNTIES—Between Jahant Corner and one mile north of Galt, about 5.0 miles to be graded and paved with Portland cement concrete. District X, Route 4, Sections D, A. Basich Brothers, Torrance, $222,466; Metropolitan Construction Co., Los Angeles, $238,480; David H. Ryan, San Diego, $209,428; N. M. Ball Sons and D. McDonald, Berkeley, $212,313; Louis Biasotti & Son, Stockton, $212,625; Union Paving Co., San Francisco, $219,860; Heafey-Moore Co., Oakland, $224,199; A. Teichert and Son, Inc., Sacramento, $249,576; Larsen Bros. and Harms Bros., Sacramento, $254,933; A. J. Raisch and Earl W. Heple, San Jose, $261,346. Contract awarded to Fredericksen and Westbrook, Lower Lake, $205,803.

SAN LUIS OBISPO COUNTY—A reinforced concrete girder overhead crossing over the tracks of the Southern Pacific Railroad about 6 miles north of San Luis Obispo, consisting of two 59-foot spans, two 50-foot 3½-inch spans, four 45-foot 4-inch spans, and two 32-foot 6-inch spans. District V, Route 2, Section D. Dimmitt and Taylor, Los Angeles, $89,946; J. S. Metzger and Son, Los Angeles, $91,570; C. O. Sparks and Mundo Engineering Co., Los Angeles, $94,015; Byerts and Dunn, Los Angeles, $94,893; A. Soda and Son, Oakland, $95,340; J. E. Haddock, Ltd., Pasadena, $98,200; Case Construction Co., Inc., Alhambra, $99,149; Werner and Webb, Los Angeles, $102,090; Lindgren and Swinerton, Inc., San Francisco, $103,467; C. W. Caletti & Co., San Rafael, $104,935; Earl Heple, San Jose, $88,535; Metropolitan Construction Co., Los Angeles, $93,750; J. F. Knapp, Oakland, $95,705. Contract awarded to R. R. Bishop, Long Beach, $84,399.

SISKIYOU COUNTY—On East Side Road in Scott Valley, between Callahan and Fort Jones, about two miles to be surfaced with screened gravel. District II. Feeder Road Section. A. Soda and Son, Oakland, $6,262; Clifford A. Dunn, Klamath Falls, Oregon, $6,415. Contract awarded to Garcia Construction Co., Irvington, $4,320.

SUTTER COUNTY—A reinforced concrete slab bridge across Sutter By-Pass, 12 miles west of Yuba City, consisting of one 73-foot span, one 73-foot span, twenty-two 15-foot spans and one hundred seventy-three 22-foot spans on concrete pile bents. District III, Route 15, Section A. J. F. Knapp, Oakland, $227,768; Campbell Construction Co., Sacramento, $237,407; Andy Sordal and R. R. Bishop, Long Beach, $239,462; Lindgren and Swinerton, Inc., San Francisco, $250,554; John Rocca, San Rafael, $250,864; N. M. Ball Sons and D. McDonald, Berkeley, $253,120; C. W. Caletti and Co., San Rafael, $256,545; A. W. Kitchen, San Francisco, $252,067; Clinton Construction Co. of California, San Francisco, $276,129; George Pollock Company, Sacramento, $278,275; Bates and Rogers Construction Corp., Oakland, $292,305. Contract awarded to Heafey-Moore Co. and Fredrickson Watson Construction Co. Fredrickson Bros., Oakland, $227,307.

SUTTER COUNTY—Between Tarke and one mile south of Sutter City, about 4.7 miles to be graded and surfaced with plant-mixed surfacing on crusher run base. District III, Route 15, Sections A, B. A. G. Raisch, San Francisco, $152,099; Hanrahan Co., San Francisco, $149,494; Union Paving Co., San Francisco, $144,233; Basich Brothers, Torrance, $149,282; Louis Biasotti and Son, Stockton, $165,747; Larsen Bros. and Harms Bros., Sacramento, $138,571; Heafey-Moore Co., Oakland, $149,500; A. Teichert and Son, Inc., Sacramento,

(Continued on page 27)



DIVISION OF WATER RESOURCES

OFFICIAL REPORT

FOR THE MONTH OF

November, 1937

EDWARD HYATT, State Engineer



WORKING under an agreement with the U. S. Bureau of Reclamation, the Division of Water Resources has continued the making of surveys and the collection and compilation of data in the San Joaquin Valley in connection with the acquisition of lands and water rights and the exchange of water for lands not acquired. Negotiations were continued with the owners of these lands and water rights in connection with their acquisition for the project. Negotiations were also continued with public utility companies for the relocations of their facilities which would interfere with the construction of certain units of the project. Studies were continued and conferences held in connection with the disposal of water and power to be made available by the project.

Announcement was made during the month that a capacity of 4,500,000 acre-feet has been selected for the Shasta Reservoir, formerly Kennett Reservoir. The dam for this reservoir will be approximately 500 feet high, above the present stream level, and will be the second largest concrete dam in the world.

FLOOD CONTROL AND RECLAMATION

Maintenance of Sacramento Flood Control Project.

The small regular crew has been engaged on routine maintenance during this period. The rainfall occurring during the latter half of the month has made it necessary to operate the drainage pumping plants at intervals, but the total local drainage runoff has been moderate.

Due to excessive and unusual rainfall in the watershed of the upper Sacramento River, the Sacramento River rose to medium flood stage and crested at Colusa on November 22, 10 p.m., at 24.9 feet on the gauge. The Moulton, Colusa and Tisdale weirs have been discharging water into the by-pass since November 21, and Butte Basin is overflowed. Water commenced discharging over Fremont weir late in the afternoon of November 24 and it will continue for several days, at a depth of from one to one and one-half feet.

Relief Labor Work.

All WPA projects have been inactive during this period owing to lack of men on relief. On November 8, work was started on clearing in the Tisdale By-pass with a crew averaging 25 men from SRA Transient Camp No. 7 in Sutter Basin, this office furnishing tools, supervision and transportation. Work has been suspended since November 21 on account of the overflow of the by-pass from the Tisdale weir.

Bank Protection Program.

Work has been continued on the construction of bank protection at various points in the Sacramento River by the California Debris Commission, under the current program being done under the 1932 agreement. However, the unseasonable rise in water stage has necessitated the discontinuance of practically all of this work. Some damage has resulted in the erosion of new earth-fill material.

IRRIGATION DISTRICTS

An annual report on irrigation districts was completed and published during the month as Bulletin No. 21-H of the Division. This is the ninth of a series of these publications dealing with the history and activity of districts formed under the California Irrigation District Act. The present report contains information and statistical data collected for the year 1936, and contains a discussion of the refinancing programs being carried out by many of the districts through loans from Reconstruction Finance Corporation.

A publication containing a revision of the Irrigation District Laws is now in preparation. It will include amendments and new provisions passed by the Legislature in 1937, and when completed will be printed as Bulletin No. 18-E.

WATER RIGHTS

Supervision of Appropriations of Water.

Thirty-four applications to appropriate water were received during October, six were denied and twelve were approved. Seven permits were revoked and seven passed to license. On October 1, forms were forwarded to 1294 permittees requesting a report of progress for the past year and on October 15, forms were forwarded to 522 licensees requesting reports of use and changes during the past three years. On November 1, 831 of these reports had been received and these are in process of study with a view to such action as may be appropriate in the various cases.

SACRAMENTO-SAN JOAQUIN WATER SUPERVISION

During the past month the field work of this office has been virtually completed and the field data gathered is being assembled preparatory to making the office computations of diversions, acreage irrigated, stream and return flows in the Sacramento and San Joaquin valleys. These data will all be assembled and published in a mimeographed report of the Division of Water Resources.

CALIFORNIA COOPERATIVE SNOW SURVEYS

During the past month work has been directed toward concluding arrangements with the personnel of the various cooperating agencies throughout the State for the conduct of the coming winter's snow surveys. In this connection, instruction has been given to the personnel of various cooperating agencies in the methods of making the surveys.

Work was completed on the construction of a shelter cabin in the Kern River watershed and this and several other cabins were stocked with food and supplies for winter use by snow surveyors.

Considerable work was done in placing markers along trails leading to snow survey courses so that they may be more readily followed during periods of deep snow.

FEDERAL COOPERATION—TOPOGRAPHIC MAPPING

During October progress was made with field work in connection with the San Bernardino No. 3 and San Bernardino No. 4 quadrangles and office work was performed on the Downieville No. 1 quadrangle.

Final maps of the San Francisquito quadrangle in Los Angeles County are now available. This sheet is published on a scale of 1:24,000 with a contour interval of 25 feet.

Boss: "Now be careful with that money I gave you, son. Remember the saying, 'a fool and his money are soon parted'."

Boss' son: "Yes, Dad, but I want to thank you for parting with it, just the same."

State Experiments With Highway Safety Lighting

(Continued from page 15)

For instance, in single-car accidents on State highways—for both daylight and darkness—where only a single motor vehicle was involved, 54 per cent of all the causes reported was made up of "Speed excessive for conditions," "Pedestrian involved," and "Driver had been drinking."

In two-car accidents, where two or more motor vehicles were involved, we find that "Driver had been drinking," "Speed excessive for conditions," and "Improper passing" again contribute to more than 50 per cent of the total.

On the basis of their occurrence, we discover that accidents involving drivers who had been drinking were over seven times more frequent at night, excessive speed 2.6 times, and improper passing 1.8 times than under daylight conditions.

ONLY A MINOR FACTOR

Taking the three major causes—drinking drivers, excessive speed, and improper passing—which together account for more than half of all causes reported for night accidents, it is clearly apparent that the absence of daylight is only a minor factor in their increase at night. It is difficult to see how the artificial restoration of a portion of daylight can of itself, without the aid of other remedies, be expected to bring about any radical change in these causes.

However, since the real proof of the value of highway lighting can come only from the record of well-conducted experiments it is hoped that much may be learned from the two installations which will shortly be made.

The plans of the above projects were developed by Colonel J. H. Skeggs, State District Engineer of San Francisco, and the installation is under his direct supervision.

Clerk (in private office): "As I am getting married, sir, is there any chance of an increase in salary?"

Boss: "If you don't get out of here quick, we'll make you a partner and you won't get anything."

New Type of Reflecting Curb Has Been Designed

(Continued from page 8)

reflecting facets designed to proper depth and angle produced an effect markedly superior to other curbs when viewed under rays of automobile headlights. Additional benefit was derived by painting the reflecting plane with white paint and this was improved by impregnating the paint with glass beads.

Two types of recess forms which appeared to be the most effective have been adopted for construction:

First, a simple type of wedge shaped indentation is most suitable for central dividing strips where traffic movement approximately parallels the curbs.

Second, a block type with all faces of the recess sloped to reflect light, is more effective for intersection islands and curb returns, where headlights are directed against them at more abrupt angles.

In the plan and specification for the curbs regard has been given to practical and economical construction and to their durability and maintenance.

Although some change in design may increase the effective visibility of the recessed curb face, the types indicated are being constructed.

This reflecting type curb is a development of a design observed in the State of New Jersey.

HIGHWAY BIDS AND AWARDS

(Continued from page 25)

$153,878; Poulos and McEwen, Sacramento, $144,897; Fredericksen and Westbrook, Lower Lake, $133,751. Contract awarded to Hemstreet and Bell, Marysville, $133,596.55

TULARE COUNTY—Between 1.8 miles west of Merryman and Yokohl, about 3.1 miles, to be graded and surfaced with plant-mixed surfacing on crusher run base. District VI, Route 10, Sections C, D. Piazza and Huntley, San Jose, $82,162; Griffith Company, Los Angeles, $88,919; Oswald Bros., Los Angeles, $97,928; Hanrahan Company, San Francisco, $105,702; J. A. Casson, Hayward, $98,103; Union Paving Co., San Francisco, $86,499. Contract awarded to N. M. Ball Sons, Berkeley, $81,444.

Tramp: "Lady, I'm dying from exposure."

Woman: "Are you a tramp, politician or financier?"

New Arroyo Seco Parkway Will Benefit Many Southern Cities

(Continued from page 11)

new highway, which will pass beneath Arroyo Drive, Grand Avenue, Orange Grove Avenue, Prospect Avenue, Meridian Avenue, Fremont Avenue, Union Pacific and Santa Fe tracks and Fair Oaks Avenue in South Pasadena. At each of these locations it will be necessary to build separation structures.

In the case of the bridge at Arroyo Drive a single span structure about eighty feet long will be used. Encased in the structure, immediately below the deck and entirely concealed from view, will be the large Pasadena sewer.

CONTINUOUS BRIDGES

In the case of the other structures through South Pasadena it has been found economical to make use of continuous bridges with extremely shallow deck construction. This type of construction will be used so that roadway excavation cost may be kept to a minimum.

The design of the structures to fit conditions entails the usual problems which are encountered in highly developed areas. The work will be planned in such manner that construction work will not unduly inconvenience traffic over the many cross streets affected. Rail traffic must be kept going while the Union Pacific, Santa Fe and Pacific Electric grade separations are being constructed. Through the cities, utilities and tracks must be shifted as necessary to facilitate construction.

Due to the high development of the territory careful consideration is given to the engineering and architectural treatment of the structures to the end that utility, beauty and economy may be the result.

The building of the bridge over the Arroyo Seco channel and the eighteen grade separation structures will make it possible for the new Arroyo Seco Parkway to serve well the growing communities to the northeast of Los Angeles and as a result of the construction, these communities will enjoy a transportation convenience which will pay big dividends for many years to come.

Right of Way Men Hold Meet in Sacramento

A SEMINAR for right of way attorneys, right of way agents and right of way engineering assistants engaged in the acquisition of lands and easements required for the development of the State highway system and the completion of the rail transportation facilities for the San Francisco-Oakland Bay Bridge was held at Sacramento November 18 and 19, 1937. C. C. Carleton, Chief of the Division of Contracts and Rights of Way, presided over the sessions.

APPRAISAL PROBLEMS

Among the many topics discussed were appraisal problems; condemnation practice and procedure; procedure on claims before the State Board of Control; relinquishments and abandonments of existing ways; 1937 legislation in so far as it concerns right of way activities; civil service problems affecting the hiring of appraisers and court witnesses; practice in the removal or demolition of buildings; right of way fences; encroachments on right of way; conveyancing forms; acquisition of rights of way for subway and overhead railroad grade separations, etc.

The high light of the meeting was the intensive study of acquisition problems arising out of the increased use of new and advanced types of highway construction by the State.

Those in attendance included Clarence W. Morris, San Francisco, Frank B. Durkee, C. R. Montgomery and Robert E. Reed, Sacramento, Attorneys for the Division; Holloway Jones, Clifford D. Good, Lincoln V. Johnson and George Hadley, Condemnation Investigators, San Francisco; C. A. Marsh, Supervising Right of Way Agent, San Francisco-Oakland Bay Bridge, San Francisco; L. P. Bolander, Jr., Assistant Right of Way Agent, San Francisco-Oakland Bay Bridge, San Francisco; S. W. Elliott, Right of Way Agent, District I, Eureka; Leland L. Rose, Right of Way Agent; John W. White and John R. West, Assistant Right of Way Agents, District II, Redding; Herman D. Jarrett, Right of Way Agent, Richard H. Ramsey, Assistant Right of Way Agent, and J. F. O'Hara, Assistant Highway Engineer, District III, Marysville; James B. Woodson, Right of Way Agent, Roy C. Teel and E. Kenneth Rogers, Assistant Right of Way Agents, and Fred G. Beckner, Assistant Highway Engineer, District IV, San Francisco; G. J. Grohman and Orr Stephens, Junior Highway Engineers, Sacramento; E. W. Carson, Right of Way Agent, C. L. Slusher and J. M. Sorensen, Assistant Right of Way Agents, District V, San Luis Obispo; Henry Sellers, Right of Way Agent, Wiley D. Ambrose, Assistant Right of Way Agent, and F. M. Roush, Assistant Highway Engineer, District VI, Fresno; Frank C. Balfour, Supervising Right of Way Agent, E. N. Whittemore and Leo J. McCarthy, Right of Way Agents, William L. Mills, Neil C. Brown, Earle R. Bunker, Joseph F. Walsh and E. F. Wagner, Assistant Right of Way Agents, and Harold W. Leonard, Assistant Highway Engineer, District VII, Los Angeles; Edward P. Jones, Right of Way Agent, and Charles L. Flack, Assistant Right of Way Agent, District VIII, San Bernardino; F. R. Baker and M. Harris, Associate Highway Engineers, and Serge Ray, Junior Highway Engineer, District IX, Bishop; B. J. Perry, Right of Way Agent and Louis J. Malatesta, Assistant Right of Way Agent, District X, Stockton; George S. Pingry, Right of Way Agent, and A. J. Razeto, Assistant Right of Way Agent, District XI, San Diego.

Feather River Route a Credit to the State

Returning vacationists who traveled the new Feather River Highway seem to be about evenly divided into two factions, one of which contends that the highway is outstanding because of its engineering accomplishments, the other praising its beauty; they unite in proclaiming it the greatest stretch of automobile roadway in the state.

Designed to provide another eastern entrance to the state, it is predicted that the attractiveness of this highway will be an inducement that will make it one of the most heavily used routes.—*Pacific Motorist.*

November Sees Traffic Drop On Bay Bridge

VEHICLES totaling 9,721,328 have crossed the San Francisco-Oakland Bay Bridge during the first twelve and one-half months of operation, State Director of Public Works Earl Lee Kelly announced following a report of the span's November traffic by State Highway Engineer C. H. Purcell.

A drop in number of over 500 vehicles in the structure's daily average was reported for last month's traffic, with an average of 23,308 vehicles for November, compared with 23,834 for October.

There was a general drop in all classifications of vehicles, Mr. Kelly said. Total vehicles for November numbered 699,229 as against 738,868 for October. The lowest day was November 16, a rainy day, when 17,506 vehicles crossed the span. High day was November 6, with 32,195 vehicles. A 30-day, four-Sunday month, together with stormy weather conditions, was among the factors attributed to the traffic drop by Mr. Kelly.

Total earnings for the month were $369,869.90—compared with $393,465.25 for October.

Comparative figures for October and November, with total vehicles to cross the bridge to date, follow:

	Passenger Autos	Auto Trailers
Total Oct.	695,079	1,327
Total Nov.	657,901	954
Total since opening	9,247,521	16,660

	Motorcycles	Tricars	Trucks
Total Oct.	2,729	836	27,145
Total Nov.	2,220	913	25,918
Total since opening	34,240	8,125	300,869

	Truck Trailers	Buses
Total Oct.	1,299	10,453
Total Nov.	1,233	10,090
Total since opening	21,503	92,410

	Total Vehicles	Extra Passengers	Freight Pounds
Total Oct.	738,868	184,416	69,243,169
Total Nov.	699,229	179,178	62,451,501
Total since opening	9,721,328	2,036,598	688,524,183

"Was that an explosion at your house last night?"

"Yes, there was powder on my coat."

STATE OF CALIFORNIA

Department of Public Works

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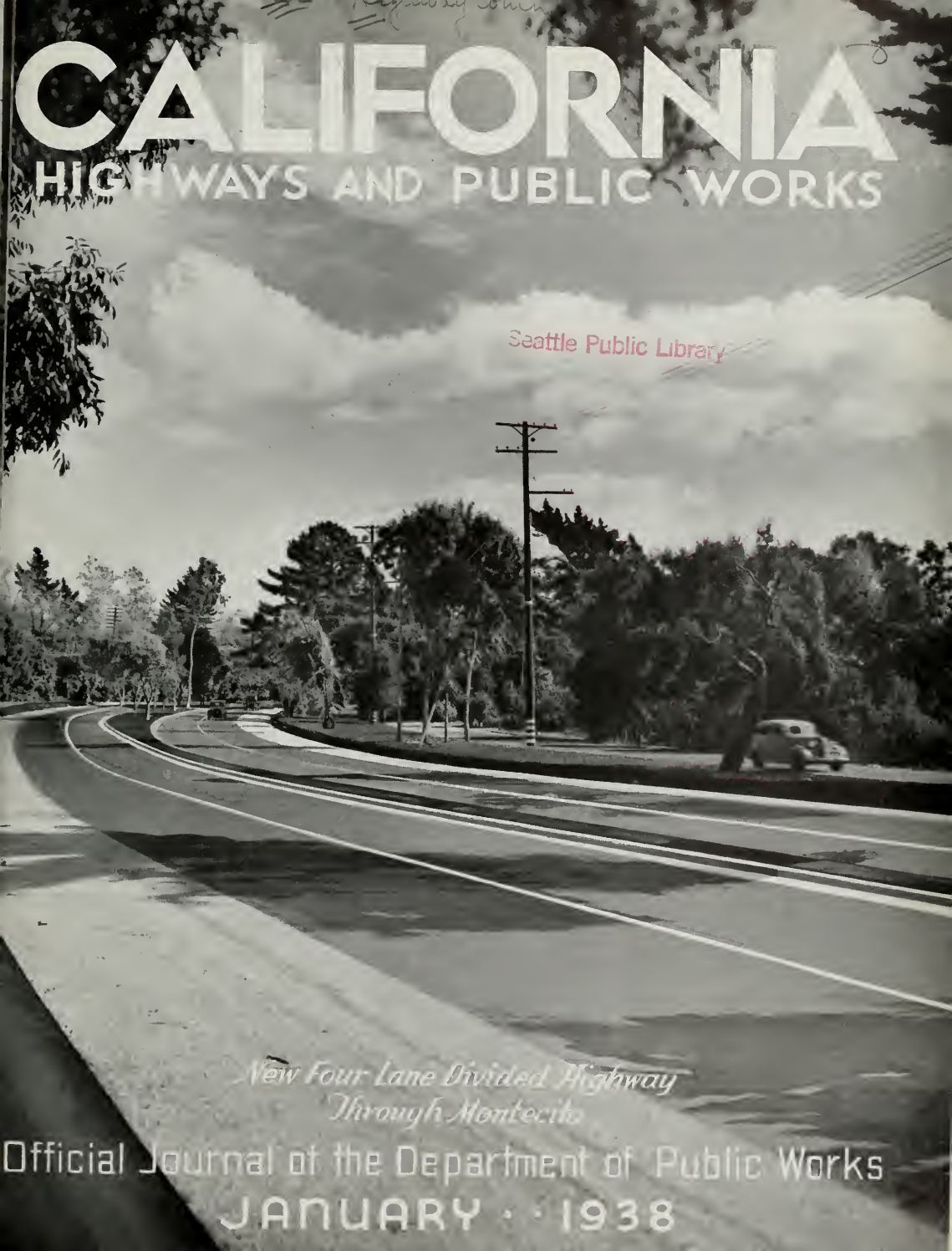
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New Four Lane Divided Highway
Through Montecito

Official Journal of the Department of Public Works
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1938

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways of the Department of Public Works, State of California

EARL LEE KELLY, Director C. H. PURCELL, State Highway Engineer JOHN W. HOWE, Editor K. C. ADAMS, Associate Editor

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Proposed Decrease in Federal Aid Would Eliminate $8,200,000 From Current Biennial Highway Budget

By EARL LEE KELLY, Director of Public Works

CALIFORNIA, in common with all the other States of the Union, is greatly concerned over a proposal now before Congress to curtail Federal aid highway appropriations which, if approved, means the elimination of projects totaling approximately $8,200,000 from our current State highway budget and the loss of $4,000,000 per year thereafter.

Section 12 of the Hayden-Cartwright Road Act of June 18, 1934, provides that any State that diverts gasoline taxes and other motor vehicle revenue from highway purposes in greater amount than provided by law on the date of passage of the act shall be penalized not to exceed one-third of the Federal aid funds made available to that State in any year.

This penalty has been levied in several States yet Congress is asked to reduce Federal allocations for highway purposes in spite of the fact that gasoline users pay a one cent per gallon tax to the Government in addition to excise taxes imposed on motor vehicles, tires, inner-tubes, oil, etc., all amounting to approximately $327,000,000 per year.

GOVERNOR'S VIEW

Governor Frank F. Merriam, while an exponent of balanced budgets, State and National, and a firm believer in governmental economies, is of the opinion that curtailment of highway construction is not helpful economy because such curtailment will add to unemployment and deprive the public of needed road improvements. The Governor says concerning the proposal before Congress:

"I am informed that in 1936 the Federal Government collected $186,542,000 through its own gasoline tax of 1 cent a gallon, and $140,495,000 in other excise taxes on motorists. Collection of $186,000,000 in gas taxes and the curtailment of highway appropriations to $125,000,000 would



EARL LEE KELLY

seem to me to be the same sort of gas tax diversion by the Federal Government for which it has penalized several States.

"Approval of the proposal submitted to Congress not only would throw vast numbers of persons out of employment but would discourage general contracting and manufacture of heavy materials and equipment."

THE RECOMMENDATIONS

The recommendations before Congress are as follows:

(1) Cancellation of a $214,000,000 apportionment authorized for distribution among the States for the fiscal year ending June 30, 1939.

(2) Distribution of $200,000,000 of unappropriated 1938 fiscal year funds over the next two fiscal years.

(3) Limitation of annual appropriations to $125,000,000 for 1940 and thereafter for the next few succeeding years compared to $238,000,000 allocated under the Act of June 16, 1936 for 1938 and 1939.

EFFECT ON CALIFORNIA

The effects on California's highway construction this proposed legislation would have are outlined as follows:

(1) Cancellation of the fiscal year 1939 apportionments for regular Federal Aid, feeder roads, and grade crossings would mean the elimination of projects totaling approximately $8,200,000 from the current biennial budget.

This total is derived in the following manner:

In the State highway fund budget for the current biennium, July 1, 1937, to June 30, 1939, there was included anticipated regular Federal Aid revenue in an amount of $9,500,000 which was all allocated to projects. The 1938 apportionment in an amount of $4,858,220 has already been received leaving a balance of $4,641,780 anticipated 1939 regular Federal Aid.

The feeder road apportionment for the next fiscal year should be approximately the same as for the present year in an amount of $971,644 as should the grade crossing set-up for $1,874,656. Summarized, the loss of funds for 1939 through the proposed cancellation of Federal Aid is as follows:

Anticipated 1939 Federal Aid	$4,641,780
Anticipated 1939 Feeder Funds	971,644
Contribution by Counties to match Feeder Funds	703,604
Anticipated 1939 Grade Crossings	1,874,656
	$8,191,684

(Continued on page 9)



View of intersection of Eucalyptus Lane and San Ysidro Lane in Montecito showing break in curb at intersection.

MODERN SEPARATED HIGHWAY IN MONTECITO

By E. R. GREEN, District Construction Engineer

UPON the acceptance, on October 28, 1937, of the Miramar Avenue-Olive Mill Road project, which was through the Montecito area, adjacent to the city of Santa Barbara, an important, though short, link of reconstruction in the Coast Highway (U. S. 101) was completed.

Before reconstruction at this location there was an average traffic flow of 12,000 vehicles daily over a three-lane highway on which the sight distance was very limited by reason of horizontal and vertical curvature. There existed only a 60-foot width of right of way through a highly developed and exclusive residential district, that has long been noted for its beauty and abundant growth of trees and shrubbery.

These surroundings, while pleasant to drive through and beautiful to view, in no way helped the sight distance, as both shrubbery and trees encroached well within the highway right of way. Added to the above mentioned adverse conditions for through travel was a considerable amount of local travel entering the traveled way from side roads, which by reason of poor visibility, materially increased the hazard to both local and through traffic.

Northerly from this project for a distance of ¾ mile, extending through a zoned business district, a four-lane pavement had been constructed in 1934 by the Division of Highways, to the south city limits of Santa Barbara. A continuation of this improvement, on the project in question, presented the problem of adequate provision for through traffic, the preservation of all trees, shrubbery, and landscaping possible, and at the same time provide a safe access to the highway for local traffic.

Surveys were made which included the exact location, size, and character of all trees and shrubbery, together with local improvements. This information was utilized to the fullest extent in planning for their preservation on the reconstruction of the highway.

COOPERATIVE PROJECT

Working in conjunction with the District, Survey and Plans Department, and the Santa Barbara Planning Commission, L. Deming Tilton of the State Planning Commission presented a plan which he had long cherished, whereby an 180-foot width of right of way would be acquired (100 feet by the State and the additional 40 feet on each side by a cooperative arrangement between the State and county.)

A four-lane pavement with a central dividing strip was designed for the accommodation of through traffic, while local traffic would be served by parallel two-lane roads on each side. These side roads would have access to the central or four-lane through road only at fixed intervals.

The plan provided for a distinct separation between the side roads and the main thoroughfare by parkway areas of variable widths. Alignment and grades on the service roads were not planned to conform with the central four-lane pavement in that they were designed to blend more closely with the natural topography of the area and at the same time preserve to the greatest extent possible the existing trees and shrubbery.

TILTON PLAN ADOPTED

After due consideration by all parties concerned, Mr. Tilton's plan was adopted. By agreement with Santa Barbara County, the construction costs of the side or service roads was borne by the county and were constructed by county forces working under the direction of the Santa Barbara Planning Commission and Assistant County Engineer E. B. Brown.

The roadway design for the side roads consisted of an 18-foot width of natural asphalt surfacing—a local



This picture shows westerly end of Montecito project at Olive Mill Road. Local service roads shown on left and right.

product from the Carpinteria pit—4 inches thick, laid in two courses over a waterbound rock base. Three foot oil mixed shoulders were placed on each side.

The central four-lane pavement constructed by the State was of 7 inch asphaltic concrete laid on an imported borrow base 6 inches thick, in two 20-foot lanes, with 9-inch outside edges, except on portions of second story work where the minimum thickness of surfacing was 3 inches.

NEUTRAL ZONE FOR TRAFFIC

These opposing 20-foot traffic lanes were separated by a concrete curb-lined dividing strip, generally 4 feet in width, except at a provided intersection with the side roads at San Ysidro Lane where the dividing strip was gradually increased over a distance of 500 feet to a width of 25 feet just before reaching the intersection. A gap in the parting strip, symmetrically rounded, was, of course, necessary at this intersection to allow access from the side roads.

The additional width of the parting strip, on the four-lane or central roadway at the San Ysidro Lane intersection, was designed to provide a neutral zone in which cars could come to a stop after crossing one lane of traffic and before entering, or crossing, the opposing line of traffic.

The curbs bordering the parting strip were constructed to a height of 4 inches above the pavement grade and were finished with white Portland cement mortar, which makes an effective contrast with the dark pavement, thus greatly increasing their visibility, particularly for night driving. The intervening space between curbs was filled with selected top soil and it is planned to plant low type shrubbery or ice plant on this area.

Oil mixed, selected material, shoulders 8 feet by 4 inches were constructed on the outside of each 20-

(Continued on page 23)



Rolled curb on parting strip is revealed by this photograph. Public utility poles are concealed by trees.



This is type of auger blower rotary snow plow, nine of which Division of Highways has added to its snow removal equipment for work in mountains this winter.

State Buys Nine More Snow Plows For Winter Work

THE Division of Highways will shortly place some nine additional auger blower type rotary snow plows at various locations where last year's storms indicated their necessity.

With these additions, the State will be equipped with twenty-five modern rotary plow units, which are used in conjunction with the push type plow in removing the windrowed snow from the highway. It is hoped that these additional units will insure a more continuous use of our snow routes and permit the programming of snow sports with more or less certainty, except in the case of very unusual and heavy snowstorms.

Assignment of plows this year and last year is shown as follows:

	1937	1938
State Route 3—Pacific Highway, U. S. 99		
Mt. Shasta City	1	2
State Route 28—Redding-Alturas, U. S. 299		
Burney Mountain	1	1
State Route 29—Red Bluff-Susanville, State Sign Route 36		
Mineral	1	1
Lost Creek	1	1
Westwood	1	1
State Route 37—Auburn-Truckee, U. S. 40		
Emigrant Gap	1	2
Donner Summit	3	3



Widening operations to clear highway of deep snow banks.

	1937	1938
State Route 15—Nevada City-Emigrant Gap, State Sign Route 20		
Nevada City	1	1*
State Route 13—Sonora Pass road, State Sign Route 108		
Sonora	1	1
State Route 125—Wawona Road to Yosemite, State Sign Route 41		
Pinehurst	1	1
State Route 76—Huntington Lake Road, State Sign Route 168		
Shaver Lake	--	1
State Route 23—Bishop-Bridgeport, U. S. 395		
Crestview Summit	1	1
Conway Summit	1	1
McGee Creek	--	1
State Route 43—Lake Arrowhead Route, State Sign Route 18		
Burnt Mill	--	1
Lakeview	1	2
Fawnskin	1	2
State Route 31—Cajon Pass, U. S. 395, U. S. 66		
Cajon Pass	1	1
State Route 190—Camp Angelus Road		
Camp Angelus	--	1
State Route 61—Angelus Crest Road		
La Canada	--	1
Totals	17	26

* Rotary widener.

(Continued on page 27)

HIGHWAY INVENTORY

By J. G. STANDLEY, Principal Assistant Engineer

FEW people realize that in America today no State has an adequate road system. Yet our roads are the basis of transportation —the major factor in modern life. An adequate road system may be said to be one which in mileage, character, and upkeep is equal to or greater than the economic demands of traffic.

Economic demands of traffic may be defined in this case as a road or road improvement that costs the motorists, community, or State more not to have than to buy and pay for. No State has reached this goal and California does not at this time lead the various States in approaching such a goal.

HIGHWAY TRAVEL CHEAP HERE

Today California ranks first in the number of automobiles and trucks registered. However, while California ranks first in registration, it ranks fourth in gross receipts from motor vehicle fees and gasoline taxes and forty-second in total receipts per motor vehicle. In other words, there are only six states where the average motorist pays less for using the highway than in California.

While the registration in California increased 8.2% in 1937 over 1936, highway facilities in this State have not kept pace with this increase.

Let us stop and analyze the status of our present California Highway System. This system comprises 14,000 miles and today carries approximately 75 per cent of the rural traffic in the State.

Of the 14,000 miles:

26%, or 3,640 miles, are as yet unimproved;

41%, or 5,656 miles, are provided with an intermediate type surfacing;

33%, or 4,578 miles, are high type pavement.

Of this mileage thus improved, approximately 7,500 miles are now of inadequate width and design to efficiently carry the traffic.

On the system there are approximately 30 main artery highway intersections crossing at grade where separations are justified.

There remain approximately 250 railroad grade crossings justifying separations.

There are 3,300 bridges on the State system, of which only 1,750 have been constructed by the State, the remainder being existing bridges on roads taken into the State Highway System.

Of these 3,300 bridges, only approximately 1,000 are fully adequate.

Of the remaining 2,300, approximately 1,000 are weak; 1,100 are too narrow, and 320 have inadequate or dangerous approaches.



J. G. STANDLEY

NEW BRIDGES NEEDED

While, because of the obvious impossibility of doing all the work at once, accurate estimates are not available of the total cost of giving California an adequate road system, nevertheless we do know that of the 2,300 inadequate bridges mentioned above, there is a crying need at the present time for the removal of at least 250 of the old county bridges that at this time are an absolute hazard, representing an approximate expenditure of $7,000,000.

Of the 7,500 miles of road of inadequate width, there is absolute congestion at peak hours on about 1,000 miles where at least four lane divided roadway should be provided, representing an approximate cost of $75,000,000.

Of the 30 important road intersections where separation is justified, the justification lies largely in the removal of the hazard and saving of lives, which can not be measured in dollars and cents. Such obligations would cost in the neighborhood of $200,000 each and in many cases where right of way difficulties are encountered and where clover leaf or similar designs are desirable, the cost would be several times this amount.

Approximately the same thing applies to the railroad grade separations. These are bare necessities and it does not take a mathematician to see where we stand at the present time.

NEED FOR SAFETY

Consistently increasing traffic and continuously improved mechanical efficiency have accelerated demands for safety and comfort while revenue has followed a uniform velocity of return. Where construction lags behind traffic needs, congestion results with its attendant hazards. While accidents directly chargeable to highway defects are proportionately few, they are sufficient in number to emphasize the necessity of overlooking no opportunity to prevent them in so far as reasonably possible; all of which again emphasizes the need of widening our roads and strengthening our bridges with the greatest possible speed until an adequate system can be more nearly approached or realized.

To handle this problem and keep pace with traffic, California has the returns from a 1½ cent gasoline tax

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Stately Campanile Erected On Highway In Honor of Old Mission

By H. DANA BOWERS, Highway Landscape Engineer

AN UNUSUAL Federal Aid roadside development project has recently been completed in San Benito County at the intersection of the Prunedale Cut-off, State Highway Route 2, U. S. 101, and the "Rocks" Road, State Highway Route 22, leading to San Juan Bautista.

San Juan Bautista lies 16 miles north of Salinas on what was formerly the old Coast Highway, El Camino Real. The elimination of the San Juan Grade by the relocation and construction of the Prunedale Cut-off, leaves the town approximately three miles east of the main traveled route and it is now reached by a connecting road called the "Rocks" Road. The name "Rocks" is derived from the Bandit Rocks a mile to the south, scene of old-time desperado activities.

OLD MISSION TOWN

The town of San Juan Bautista, which developed from a small pueblo of some fifty inhabitants in 1839, derived its name from the Mission San Juan Bautista, founded in this locality in 1797 by the superior of the missions, Friar Presidente Fermin Francisco de Lasuen.

Because of the historical and romantic background that surrounds this beautiful old mission, and in accordance with its policy of perpetuating and indicating the locations of all points of historical interest, the Division of Highways and the U. S. Bureau of Public Roads approved an appropriate roadside treatment of the intersection of the main traveled highway and the "Rocks" Road as an attractive indication to the traveler that one of California's historic old missions lay only a short distance away.

The cross and the campanerio or campanile, with its mission bells and adobe construction were selected as the motif of the development.

Additional right of way, forming a triangular area of the intersection, was acquired and this area was enclosed with adobe walls. The west wall along the main highway is seven feet in height, the northeasterly curved wall is six feet and the southeasterly curved wall is seven feet in height. The additional height of the southeasterly wall was used to screen a cut slope. All walls are two feet in thickness with the low curb walls being twenty inches in height and placed to form an enclosure and a protection for the planted areas.



Cross and campanile with its mission bells form motif for Prunedale Cut-off Intersection improvement.

The campanile is located in the northeasterly area and the cross directly opposite, in the southeasterly area. Boxed olive trees were placed to produce a framing effect for both objects. The campanile was purposely placed on the northeasterly side by reason of the silhouette effect obtained against a background of rolling oak-dotted hills, and this effect is accentuated when approaching the intersection from the south over a vertical curve.

Many plants, introduced by the padres and commonly seen in the patios of the old missions, were used in the landscaping. Pepper trees were planted behind the wall on the west side for windbreak purposes and to give the effect of depth and background.

WATER WELL DUG

Water, for the maintenance of the plants, is secured from a well dug several hundred feet to the south and the installation of a gasoline pump and water lines.

Unlike ordinary adobe bricks, used in the construction of the mission, the bricks used on this project were stabilized with asphaltic emulsion. Considerable difficulty was encountered, at first, in preparing a satisfactory proportion of soil, sand, straw and asphaltic emulsion that would sun-dry without cracking. It was found that the adobe material stockpiled and designated for use in the manufacture of the adobe brick was unsatisfactory for this purpose. It was impossible to use this material on a satisfactory and economic basis for the production of the larger volume needed for the project.

As a result of experiments, the adobe material was rejected and top soil consisting of a sandy loam, combined with aproximately 50 per cent sand from the San Benito River was



Campanile and roadside beautification at intersection of U. S. 101 and State Route 22 leading to Mission San Juan Bautista.

used in the manufacture of the brick. This blend of material, when mixed with asphaltic emulsion as a stabilizing agent and finely chopped straw, produced a satisfactory brick.

ADOBE MANUFACTURE

A pugmill designed specifically for the manufacture of adobe brick, together with trucks, molds and other necessary equipment were rented. This machine was of home made construction and consisted of a half-round trough approximately six feet in length. In this trough a longitudinal shaft was placed on which were mounted a number of nine-inch blades set at fifteen degrees from right angle. The shaft rotated at a speed of approximately thirty-five revolutions per minute. Power was supplied by an automobile engine.

Soil, sand, finely chopped straw and asphaltic emulsion were fed into one end of the mill and mixed as the materials were worked toward the discharge end of the mill by the angular pitch of the blades. The mixture, having reached a plastic consistency, was forced from the discharge end of the mill by a set of flat spiral blades through a manually operated discharge valve into the assembled brick mold lying on a roller conveyor track immediately below the trough.

BRICK MOLDS

These brick molds consisted of two parts, a detachable bottom or pallet of lattice-like construction formed by nailing wood strips transversely across two supporting wooden members and a main body or rectangular wooden form constructed to the side and end dimensions of the brick allowing for a small shrinkage. This form slipped over and rested on the detachable bottom or pallet.

In the molding process the two parts of the form were assembled, placed on the conveyor track and filled with the required amount of the plastic mortar which was hand tamped, care being taken to assure that the corners were filled and all voids eliminated. The mortar was then struck off flush with the top of the form and the brick still encased in the molds moved down the track to await conveyance in groups of four to the drying field by a cart mounted on small rubber tires.

The cart was automatically tipped at the point of discharge by lowering the front end and backing. This action relieved a trigger which permitted the form encased bricks to slide to the ground in a continuous row. Side forms were immediately stripped and returned to the pugmill on the conveyor where they were assembled with new pallets.

MAKE 33,757 BRICKS

When the molded bricks were sufficiently dried to permit stripping the pallets, they were set on edge and allowed to continue drying for a minimum of twenty-one days before being removed to the stockpile at the site of construction.

Brick used on sloping buttresses and on short radius curves were made in forms designed to meet the special conditions. Otherwise, all bricks were molded 4 inches by 12 inches by 18 inches in size. A total of 33,757 bricks were manufactured using 7159 gallons of stabilizing asphaltic emulsion Grade "D" base, and 175 bales of grain straw approximating 75 pounds per bale. Asphaltic emulsion content was held at approximately 3½% by determining water emulsion ratio and checking this against yield. Bricks consisted of the following proportions:

Soil by volume	50%
Sand by volume	50%
Asphaltic emulsion by weight	1.75 pounds
Straw by weight	.40 pounds
Volume of brick in cubic feet	.50 pounds
Weight of finished brick (dry)	.50 pounds

Class "C" Portland cement concrete for the wall footings and structures, was purchased ready-mixed delivered to the site of the work.

On completion of the bricklaying, the walls were wire broomed to produce an aged or weathered effect which, with stabilized brick, presents a rather difficult problem, due to their hardness. Much of the expense of this aging can be reduced if the bricks are molded imperfectly. By the use of a soft mix this can be easily accomplished.

(Continued on next page)



Imposing cross, surrounded by adobe walls, guides motorists to San Juan Bautista and its famous mission.

The walls were whitewashed, using the Government Lighthouse formula except that a stain produced by soaking redwood sawdust in water was added to the whitewash to reduce the glare and to obtain a dull weathered finish.

Exclusive of the campanile and cross construction, there were 15,744 cubic feet of adobe walls laid at a cost of 51 cents per cubic foot. This cost does not include the curbs and footings, but does include the cost of materials and installation of the woodwork, tile and whitewashing.

The cross is constructed of 12 inches by 12 inches Oregon pine timbers. It is set in concrete and additionally braced at the base with adobe brick. The entire height of the cross is fifteen feet. All woodwork was adzed, burned, wire brushed and treated with hot linseed oil.

The campanile was designed after the one at the Pala Mission in San Diego County and is twenty-two feet in height. It was laid on a reinforced concrete base with a reinforced concrete core extending up through the sides and across the top. The padre tile used in the campanile construction was rounded and worn off unevenly to soften the lines and give an appearance of age.

The bells, hung in the campanile, are true mission type. They are constructed of laminated redwood, painted to resemble bronze.

In addition to the treatment at the intersection proper, the three-mile "Rocks" Road entering San Juan Bautista was landscaped with WPA funds. Trees and shrubs were planted in groups and masses to frame vistas to the foothills and to cover the cut and fill slopes.

Exceptionally fine results have been obtained on this project in the sterile soil conditions of the cut slopes by the use of a very hardy native shrub, Coyote Bush (*Baccharis pilularis*). This variety has proven to be one of the best native plants particularly where adverse soil and climatic conditions are encountered. Its development is extremely rapid, which is highly desirable in roadside planting. Roads may be constructed and completed in days but plants demand years before the results of expended labor are discernible. A rapidly developing and hardy plant is, therefore, a welcome addition to material used in roadside treatment.

Although this project is probably more pretentious and elaborate than the usual treatment rendered to roadsides generally, it presented a problem that was singular in its demands, and to achieve propriety it was essential that such treatment be on a large scale.

A child was having a geography lesson and came to the word "earth." He couldn't pronounce it; so the teacher said: "Gene, what do you live on?"

Gene looked embarrassed for a moment, then said, "Beans."

Mrs. Austin B. Fletcher Views Public Works Memorial to Husband

During the Christmas holidays, Mrs. Austin B. Fletcher, of Massachusetts, widow of California's first State Highway Engineer, visited with her daughter, Mrs. Lawrence Chapman of Stockton.

Mrs. Fletcher called at the Department of Public Works building in Sacramento to extend the season's greetings to former associates of her late husband, particularly to Miss Myrtle V. Murray, who was Mr. Fletcher's private secretary when he was Director of the Department of Public Works. Miss Murray is now Administrative Assistant to Public Works Director Earl Lee Kelly.

Mrs. Fletcher viewed for the first time the bronze plaeque which graces the board room of the California Highway Commission in the Public Works building and which bears this inscription:

"IN COMMEMORATION OF
AUSTIN B. FLETCHER
FIRST STATE HIGHWAY ENGINEER
FIRST DIRECTOR OF PUBLIC WORKS
STATE OF CALIFORNIA
1911 to 1923."

Cut in Federal Aid Would Halt Highway Work

(Continued from page 1)

(2) The second point of the recommendation which proposed spreading $200,000,000 of unobligated 1939 funds over the next two years would have no particularly serious effect on our 1938 program, as we now have agreements with the Government covering approximately 90 per cent of this fiscal year's allocation.

The only States that could operate a Federal Aid program for the next fiscal year would be those that have not obligated their funds for the current fiscal year.

We would apparently lose none of our 1938 funds but would be penalized for next year because we had placed our program under way as rapidly as possible.

BIG REDUCTION IN ROAD WORK

(3) The recommendation to limit annual appropriations to $125,000,000 annually beginning in 1940 would apparently reduce Federal Aid to California about one-half. This would mean a reduction in our highway construction program of about $8,000,000 per biennium or $4,000,000 per year beginning July 1, 1939.

If the annual appropriations beginning with the fiscal year 1940 apportionment are reduced to $125,000,000 compared to $238,000,000 at present, it is not brought out in the recommendations the manner in which the $125,000,000 will be distributed.

The recommendations before Congress propose revisions of the authorization and amendment act of June 16, 1936, which allocated $238,000,000 to the States for highway work for each of the fiscal years ending June 30, 1938, and June 30, 1939.

The authorizations under this act were as follows:

(a) Regular Federal Aid	$125,000,000
(b) Secondary or Feeder Roads	25,000,000
(c) Grade Crossings	50,000,000
(d) Forest Highways	14,000,000
(e) Public Land Highways	2,500,000
(f) National Parks	7,500,000
(g) Approaches to National Parks	10,000,000
(h) Indian Reservations	4,000,000
Total	$238,000,000

The administration of the allocations totaling $216,500,000 listed under the first five items in the preceding tabulation, is handled by the Department of Agriculture (Bureau of Public Roads) and the last three in an amount of $21,500,000, by the Department of the Interior.

Direct allocations to California, which are administered by the Division of Highways, include only regular Federal Aid, secondary or feeder roads, grade crossings, and an occasional allocation of Public Land Highway funds in a comparatively small amount. The 1938 allocation of Public Land Highway funds is being handled entirely by the Bureau of Public Roads.

California's apportionment then of the $238,000,000 for the fiscal year ending June 30, 1938, to be administered by the Division of Highways, amounts to $7,704,520 itemized as follows:

(a) Regular Federal Aid	$4,858,220
(b) Secondary or feeder roads	971,644
(c) Grade crossings	1,874,656
Total	$7,704,520

The table itemizing the $238,000,000 allocation for 1938 and 1939 reveals that if the $125,000,000 is distributed in the same proportion for each item it means a reduction straight down the line of about 48 per cent. If, however, the 1940 allocations for the last three items, which are handled by the Department of the Interior, were the same in 1940 as for 1938 and 1939, it would reduce the first group which directly affects our highway program an even greater amount.

LOSS TO STATE $8,000,000

Should all of the $125,000,000 fund for 1940 and thereafter be allocated to regular Federal Aid, for administration by the State highway departments, which appears highly improbable, it would cause no appreciable change in our regular budget program exclusive of emergency Federal funds.

As previously stated, the proposed distribution of this $125,000,000 is not defined so it is not known at this time what funds would be available for our highway construction beginning in 1940.

(Continued on page 24)

California Protests

WHEREAS, The California Highway Commission has been informed of the proposal made in Washington to reduce Federal aid to the States for the Nation's highways; and

WHEREAS, More particularly, the Commission is greatly alarmed at the serious plight in which such a course would place California's highway program budgeted, as it is, on a biennial basis and inextricably interwoven with already promised Federal funds; and

WHEREAS, Such a course would compel cancellation of about one-half of the projects already authorized by the Commission and the indefinite postponement of many projects amounting to millions of dollars, vital to the continued growth and prosperity of all sections of this State; and

WHEREAS, The resultant loss of work by persons directly employed in or engaged in businesses or industries contributing to the construction of needed transportation facilities for the use and enjoyment of the State and the Nation, would deal a most damaging blow to the public welfare; and

WHEREAS, In the opinion of this Commission, the use of Federal aid funds supplementing the outlays by the States for highway improvement has proven to be one of the most effective forces in restoring the economic balance of the State and the Nation; and

WHEREAS, The Commission is hopeful that the proposal has been made only for consideration by Congress and that when Congress hears from its constituency it will determine that such a course would be most inadvisable and contrary to the best public interest; now, therefore, be it

RESOLVED, By the California Highway Commission, now in session in the city of Watsonville, in the State of California, attended by a thousand residents of the Monterey Bay area, and other sections of the State, and backed by a hearty expression of approval by such representative assemblage, does hereby most earnestly appeal to the President and Congress of the United States that they determine not to press the passage of such legislation and that they seek to find other means of achieving the President's economic objectives; and be it further

RESOLVED, That the Secretary of the California Highway Commission send copies of this resolution to the President of the United States, the Senators from California, and all members of the California delegation in Congress.

Elimination of Newhall Tunnel Bottleneck Soon to Be Realized

By P. A. McDONALD, Assistant Engineer

HISTORIC interest has long been centered about Newhall Pass, or Fremont Pass as it is now known, which is soon to be the scene of intensive highway construction activities by the State Department of Public Works.

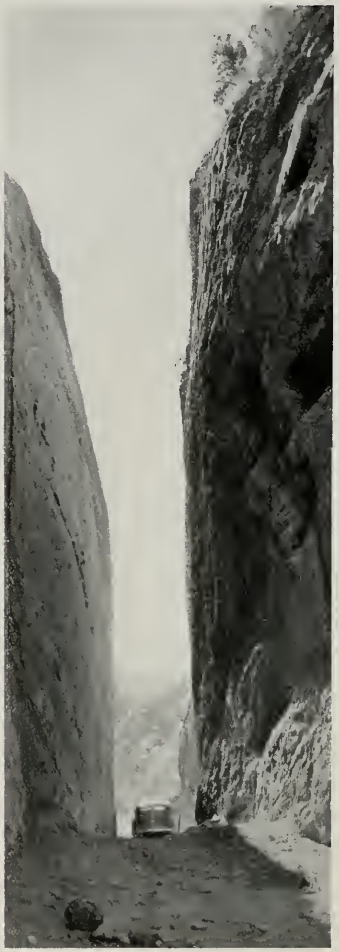
This pass divides the Santa Susana Mountains on the west from the San Gabriel Mountains on the east, and these mountain ranges in turn separate the San Fernando Valley lying to the south from the Santa Clara River Valley on the north. Through this narrow defile, the Padres and Spanish Dons of old made their way. Through it, Tiburico Vasquez and his feared outlaw bands of the lawless sixties and early seventies rode to their Soledad and Mint Canyon hideaways, and the armies of General John C. Fremont, in their journeys in the late forties, marched between Southern California and the northern sections of the State.

FREMONT PASS

The pass later became known as Fremont Pass, and it was so officially marked by the San Fernando Ebell Club on May 26, 1916, with an appropriate monument erected a short distance to the right of the present highway, and south of the Newhall Tunnel entrance. Today's traveler can easily follow the original trail from this monument through the famous Beale Cut, which was constructed by General E. F. Beale and his men in 1859.

This extremely narrow cut, through solid rock to a depth of from fifty to sixty feet, has vertical side slopes and was wide enough to allow one-way passage for the traffic of a former day. It served as the sole means of travel for early Californians between Los Angeles and northern valley points until the construction of the Newhall Tunnel, along a line some four hundred feet to the west, by the Los Angeles County Road Department in October, 1910.

The route then became a part of the State highway system in 1917, and was the only direct highway connection between Southern California and the San Joaquin Valley cities, until the construction of the Weldon Canyon Road by the State Department of Public Works in 1929.



Through Fremont Pass

Long prior to the completion of the Weldon Canyon Road, the Newhall Tunnel had become a very serious bottleneck, requiring traffic converging from several routes on the north to be confined to a narrow tunnel bore 17 feet 5 inches wide, with no sidewalks, and with narrow curbs on both sides constructed flush against the sides.

This traffic congestion was only temporarily relieved by the construction by the State of the Weldon Canyon Route, and with the steady increase in volume of traffic each succeeding year since then, the need to widen the roadway through the existing tunnel has become increasingly more urgent, and is now to be met by the Department of Public Works.

The California Highway Commission has set aside $215,000, and plans have been formulated toward eliminating this bottleneck.

TUNNEL 434 FEET LONG

The existing tunnel is 434 feet in length and, measured by present day standards, is narrow, dark, and foreboding looking. It promptly becomes a one-way road on the appearance of limit loaded vehicles. The speed of all traffic using this route is therefore necessarily reduced to that of the slowest moving vehicle, or, due to the heavy trucking on this route, to generally the speed of a truck and trailer negotiating the six plus per cent grade of either approach, causing traffic on peak days to be jammed for a mile or more from the tunnel portal.

Route 23 is important in that it delivers traffic through the Newhall Tunnel between the Los Angeles metropolitan area and the interior valleys, serving as the best access to Los Angeles from all the East Sierra region, the Owens River, and the Antelope Valleys. The same holds true for the recreational and play-

(Continued on page 21)



Upper—Newhall Tunnel, narrow bore on Route 23, long has been a serious bottleneck for traffic between the Los Angeles metropolitan area and interior valleys. In construction of the Mint Canyon Cut-off it will be eliminated. Dotted lines on photograph indicate proposed cut slopes to abolish tunnel and provide wide roadway. Lower—Looking south on Mint Canyon short cut route, broken line indicating location of proposed new highway. Arrow shows junction of projected road with present traveled portion of Route 23.

Storm Damage to Highways and Bridges Totals $2,340,875

By C. F. WOODIN, Assistant Maintenance Engineer

A storm unequaled for both severity and the extensive area affected struck at forty-three of California's fifty-eight counties during the three days of December 9, 10 and 11, 1937, and left in its wake a devastated trail of broken bridges and damaged highways. The estimated cost to the State for highway repairs and replacements will exceed $2,000,000.

A search through the records for the past forty or fifty years reveals that but one storm approached in magnitude the recent catastrophe. In January, 1909, the entire month was one of heavy precipitation and the number of rainy days exceeded previous records and have been unequaled since. However, in the higher altitudes the precipitation fell as snow whereas the recent storm was attended by high temperatures with rain falling on old snow in the upper reaches and resulting in heavy runoffs.

IMMENSE DRIFT PILES

At Soda Springs on the Donner Summit road, precipitation amounted to 10.8 inches of rain in 48 hours. The elevation at this place is 6770 feet above sea level and precipitation at that time of the year would normally be snow. At Kennett, 7.75 inches of rain was reported for a 24-hour period, and 11.42 inches in 48 hours. Oroville's 24-hour high was 4.70 inches and an unconfirmed report stated that 16.5 inches of rain fell in 40 hours in the vicinity of Madrone south of San Jose.

In many places, the rainfall attained cloudburst proportions, bringing down drift and debris which contributed largely to the damage to bridges and fills occupied by minor structures.

Mile after mile of highway was inundated at the same time. Motor vehicles were trapped and entire towns isolated by the floods. Forty-five of the 70 miles between Gridley and Red Bluff on the east side highway, U. S. 99-E, were flooded and impassable to motor traffic. Healdsburg, Geyserville, Guerneville and Monte Rio were submerged by the overflowing Russian River. Willits, Fernbridge and Loleta in the Eel River watershed were likewise isolated by the flood waters. Inundation was generally distributed over the affected area from Alturas to Visalia.

In spite of lack of intercommunication and transportation facilities between stricken areas, rehabilitation and repair were started very soon after the subsidence of the storm. Maintenance forces working under emergency pressure cleared the roads of debris, placed warning signs and barricades to aid in the safe passing of traffic and got down to the main business of backfilling washouts, making temporary repairs to structures and establishing detours where immediate replacement of the roadway was impossible.

ROADS SOON OPENED

Because of the widespread nature of the storm, construction equipment was at a premium, slowing up the work of repair. In several locations the magnitude of replacement and protection work is equal to major construction jobs and where such work may be done without excessive delay to traffic, it will be let to contract.

Too much praise can not be given to the maintenance forces, who without reservation and at times with personal danger and sacrifice pushed ahead untiringly, upholding the tradition of their organization that "the traffic must go through." The results speak for themselves. Most of the roads were rendered passable within three or four days.

On U. S. 40 over Donner Summit, one-way traffic was in force December 13, and normal traffic movement was resumed December 20. The All-

A Great Organization

People hereabouts and, probably all over the State, appreciate the State Highway Commission and the Department of Public Works headed by Earl Lee Kelly, more, these days, than they have in the past. Following the recent severe storm the roads, especially of Northern California, were terrifically damaged. On the highways above the paving water was running from four to six feet deep; slides kept coming in constantly, bridges were washed out, approaches made dangerously impassable.

Daylight came after the havoc of the first night had been accomplished and with it, seemingly automatically, there moved into action a vast number of highway workmen and a tremendous amount of equipment and, without interruption the crews, in torrential downpours, toiled in entire disregard to hours, to get the highways back in shape to permit travel. This magnificent instant response to restoration of traffic was not recorded in isolated instances—it went from end to end of California. No publicity accompanied the movement. It was just another day's job to be attended to by the big force of highway workers and it was well handled, too, and the ravages of the storm were, after great struggle, in a surprisingly short time, overcome.

As one, comfortably seated in his automobile, looked out of his car window and watched bulldozers tearing into slides, saw steam shovels lifting debris to clear the pavement and observed men in hip-boots and sou'westers toil in the rushing waters that ran from the hillsides, they must have appreciated what the gas tax does for the traveling public—not alone that, they could not have helped but reflect that this State has a Department of Public Works under Earl Lee Kelly and a State Highway Commission of which we all can justifiably be proud.

—Ukiah Republican Press

Year-Highway into Yosemite Valley was reopened December 30; U. S. 395 in the Walker Canyon, January 3; and the Feather River Highway about January 16.

The table accompanying this article shows the estimated cost of the various classifications of rehabilitation work, segregated by Highway Districts to indicate the wide distribution of the storm damage.

EXTENSIVE BRIDGE DAMAGES

Unfortunately, the bulk of the bridge damage occurred at structures which were in good condition and whose expectant life would otherwise be continued for many years. Eighty per cent of the repair cost is for those spans with the remaining 20 per cent for the structures which would have to be replaced in the near future in any event.

Such a turn in the status of highway bridges only aggravates the conditions as set forth in the article "250 Old Bridges on State Highways Must Be Replaced Immediately" by George T. McCoy, Assistant State Highway Engineer, in the March, 1937, issue of the CALIFORNIA HIGHWAYS AND PUBLIC WORKS magazine. That bright day when all bridges on the State Highway System will be capable of carrying full legal loads must be further postponed.

FEW SLIDES CAUSED

Strange to say, with the tremendous amount of damage to road embankments and surfaces, slides in general were unusually lacking. This condition in most cases becomes a disadvantage, requiring the acquisition of other sources of material needed for the rebuilding of washed out fills. The principal damage to roads, therefore, was the scouring and melting of the embankment slopes under the powerful action of the swollen boulder and debris laden streams.

Cross culverts quickly became blocked with debris and drift and the dammed-up flood waters soon overtopped the road, carrying away huge portions of the fill. The attack coming simultaneously along many fronts was irresistible and nothing could be done at the time to ward off the disaster. Drift piling up against bridges backed up flood waters, which broke through with inconceivable velocity to undermine foundations and tear away approaches.

ESTIMATED COST OF REPLACEMENT AND PROTECTION WORK STORM OF DECEMBER 9, 10, 11, 1937.

Roads

District	Headquarters	Relocation or protection work	Replacement	Bridges	Total
I	Eureka	$25,000	$152,500	$4,000	$181,500
II	Redding	50,000	557,750	116,500	724,250
III	Marysville	72,500	180,125	126,500	379,125
IV	San Francisco		10,000	2,000	12,000
VI	Fresno		30,000	9,000	39,000
IX	Bishop	39,000	106,000	12,000	157,000
X	Stockton	500,000	307,000	41,000	848,000
	Totals	$686,500	$1,343,375	$311,000	$2,340,875

Most notable are the damages along the following highway routes:

State Sign Route 18—All-Year Highway to Yosemite.

Between Briceburg and El Portal the Merced River reached heights hitherto unknown. New channels have been formed which will definitely threaten any replacement of the highway which may be made. Channel correction and rubble masonry retaining wall protection work will be required for inclusion with the replacement project of the road.

U. S. Highway 395—South of Coleville.

The Walker River in changing its channel chose to occupy areas over which the highway had been located. As on Route 18, replacement and correction work will have to go hand in hand.

State Sign Route 108—Sonora Pass Road.

The 70-foot combination truss over the west fork of the West Walker River was entirely washed away.

State Sign Route 89—In vicinity of Woodfords and Markleville.

Seven timber bridges and portions of embankments were washed out.

U. S. 50—Strawberry to Lake Tahoe.

One bridge was undermined and heavy damage was sustained on the relatively new construction betweeen Strawberry and Camp Sacramento.

State Sign Route 89—Meyers to Nevada State Line northeast of Truckee.

Heavy erosion occurred at Emerald Bay and McKinney Creek and a good portion of a fill near Mystic was likewise washed away by the rampaging Truckee River.

U. S. 50—Donner Highway between Auburn and Truckee.

West of Cisco raging waters of the Yuba River washed out fills closing this road to all traffic. Flood waters of a side canyon on the easterly slope of Donner Pass carved a gorge across the roadway further adding to the difficulties along this road. Before the waters began to subside, work was under way to repair the damage lest closely following snows defeat all efforts to keep the road open during the remaining winter season.

State Sign Route 49—Nevada City to Sierra City.

At the historic town of Downieville located at the confluence of two branches of the North Fork of the Yuba River severe damage was suffered by both community and highway. Houses were wrecked or moved off their foundations and logs and debris from the wreckage lodged against the new concrete highway bridge collapsing one span and washing away several hundred feet of fill.

Both above and below the town, the flood removed thousands of yards of highway fill slopes. Goodyear Creek Bridge was swept away, hampering the movement of much needed supplies to the stricken areas. At Sardine Creek, west of Bassetts, the approach fill was washed out, completely isolating Sierra City.

State Sign Route 24—Feather River Highway, Oroville to Quincy.

A large granite boulder slide at the Butte-Plumas County line will require the removal of between 60,000 to 75,000 cubic yards of material before the road will be safely cleared.

Rock Creek loaded with debris and inconceivably large boulders undermined the east abutment of the new Feather River Bridge at that point, dropping one end of the specially hinged suspended steel beam span to the gravel bed. The crossings at Chambers, Chipps, Indian and Yellow Creeks were partially or entirely swept away and will involve expensive replacement.

As along other swollen streams, fill slopes were badly eroded.

State Sign Route 36—Red Bluff to Susanville.

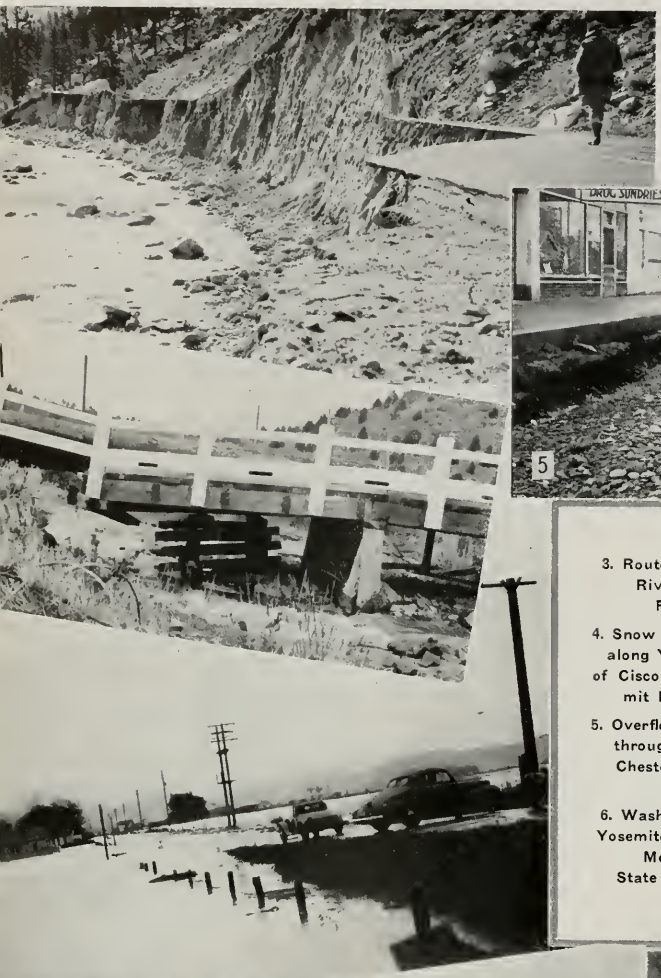
Overtopping waters of Paynes Creek washed out the east approach fill to the bridge and removed the bituminous surface from the sub-base for several hundred feet.

Near Childs Meadow, Mill Creek likewise left its channel. When it had finally subsided several hundred feet of highway had been washed out.

Debris jams diverted waters of the North Fork of the Feather River which flooded the streets of Chester and the highway to the west, carving miniature gorges and rendering the highway impassable.

(Continued on page 25)

Highways and Bridges Damaged By Unpre



1. Wash-out of Three Flags Highway south of Coleville, U. S. 395.

2. Washed-out abutment of Joseph Creek Bridge on Alturas-Lakeview Road, U. S. 395.





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3. Route 56 south of Eel River Bridge at Fernbridge.

4. Snow covered wash-out along Yuba River west of Cisco on Donner Summit Road, U. S. 40.

5. Overflow channel formed through Main Street, Chester, State Sign Route 36.

6. Wash-out on all year Yosemite Highway along Merced River, State Sign Route 18.



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6

cented Torrential Rain Storms in December







7. Yellow Creek Bridge on Feather River Highway at Belden, State Sign Route 24.

8. Approach fill wash-out at Bear Creek south of Los Molinos, U. S. 99-E.

9. Fill partially washed out along Trinity River west of Junction City, U. S. 299.

10. Undermined bridge near Dales on Red Bluff-Susanville Highway, State Sign Route 36.





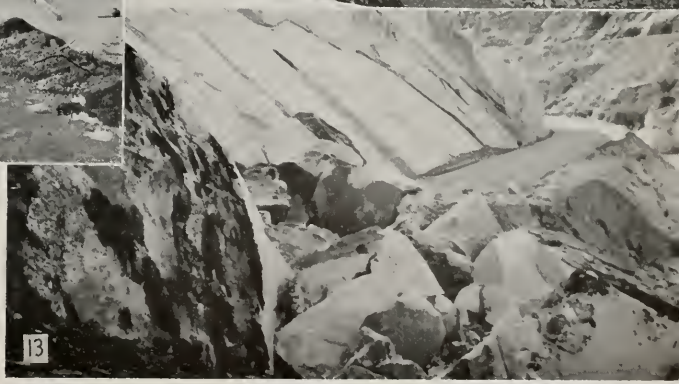




11. Wash-out east of Ingot, U. S. 299.

12. Pavement damaged by flood water east of Hamilton City, State Sign Route 32.

13. Feather River Highway covered by boulders at Butte-Plumas Line.



Floods Exact $14,000,000 Damage Toll in Sacramento Valley

By EDWARD HYATT, State Engineer

ON Thursday, December 9, 1937, the United States Weather Bureau charted "A disturbance of much intensity—over the Pacific about 600 miles off the California Coast—apparently—moving toward the coast." Southwest storm warnings were displayed on the California and southern Oregon coasts. By Friday morning rains were general over the entire State from the Mexican Border to Oregon, and serious storms had developed along the southern California Coast.

The rains continued throughout Friday and most of Saturday. South of the Tehachapi Mountains they were not remarkable but over northern California they were above normal in both intensity and total fall.

The most remarkable feature was the absence of snowfall at the higher elevations. Usually precipitation changes from rain to snow at elevations between three and five thousand feet above sea level and, during the winter months, very little precipitation occurs as rain above the seven thousand foot level. In this storm, however, rainfall was general at elevations up to seven thousand feet and over.

SNOW PACK MELTED

On Thursday the snow pack at Soda Springs, elevation 6752 feet above sea level, amounted to 13 inches. On Friday morning although 5 inches of rain had fallen the snow pack had only been reduced to ten inches. By Saturday morning an additional precipitation of 5.8 inches of rain had left only a trace of snow on the ground. In the afternoon the rain turned to snow and by Sunday morning there was a snow pack over 7 inches in depth. A similar regimen of snow, rain and snow undoubtedly occurred in the higher areas of the Cascades and the Sierra Nevada from Oregon to the Tehachapi Mountains and on higher Coastal peaks.

The rivers throughout northern California from the Kaweah to the Sacramento began to rise late Thursday night and by Friday evening were at, or rapidly rising to, flood stages in the mountain areas. These floods reached the foothills and debouched on to the valley floor Saturday evening and by Sunday morning the floods had started to recede on all streams except the Sacramento in its lower reaches. On the Sacramento River the flood crest which passed Red Bluff Saturday night reached Colusa Monday, Sacramento Tuesday and by Wednesday had passed into San Francisco Bay.

RECORD BREAKING FLOODS

In many parts of the State these floods were higher than any which had previously been recorded. On the Sacramento River at Red Bluff where a record has been maintained since 1902, the crest of the flood was over a foot higher than any previous record. The Feather River was higher than it has been at any time since 1907. In Sonoma County the Russian River is said by the older inhabitants to have been higher than it had been since 1862. In the San Joaquin Valley the Kings and San Joaquin rivers are said to have been higher than at any time since 1888.

In the Sacramento Valley, the levee system designed to protect the rich agricultural lands from floods was over taxed and failed at several points near the foothills. The Sacramento River broke out of bounds below Red Bluff and flooded the cities of Gerber and Tehama and large areas in Tehama and Butte counties mostly on the east side of the valley.

Further down serious breaks occurred in the levees on the west bank in Glenn and Colusa counties. The Feather broke through the levee at Hamilton Bend and sent a large flow across the rich farm lands north of the Sutter Buttes flooding the city of Biggs. Serious breaks also occurred north and south of Marysville. From Knights Landing south to the bay the levee system held. Opposite Sacramento the maximum flow was reduced considerably by storage in the upstream flooded areas.

MANY LEVEE BREACHES

In the coast mountains serious damages occurred in Sonoma, Mendocino, and Lake counties. The Russian River, rising to the highest levels known in over 70 years, made practically a clean sweep of the resort areas and flooded the rich farming lands in the vicinity of Healdsburg. In Mendocino County the damage was chiefly to roads and bridges and in Lake County to agricultural development.

In the San Joaquin Valley damages were chiefly confined to the Yosemite Valley, the All-Year Highway and the Yosemite Valley Railroad which were the only major developments close to the mountain river channels, and to the delta areas of the Kings and Kaweah rivers. In this latter area the levees were breached in many places and large areas were flooded.

In southern California precipitation was not excessive and there were no flood damages along the streams. However the severe storm created high waves, which combined with a high tide, did considerable damage to piers and other coastal developments along the Santa Barbara, Ventura and Los Angeles County coasts.

GOVERNOR GETS REPORT

Soon after the occurrence of the flood Governor Frank F. Merriam requested the Department of Public Works to submit at the earliest possible date, a report estimating in terms of money the damage which had occurred to the State of California on December 20th. Director of Public Works, Earl Lee Kelly requested the State Engineer's office to have this report prepared

(Continued on page 28)



Flood waters on rampage during unprecedented storm of last month. Upper—Break in levee along Sacramento River north of Colusa. Center—Flooded farm lands south of Princeton and west of Sacramento River. Lower—Flooded countryside north of Colusa. Overflowing streams did damage in the Sacramento Valley in excess of $14,000,000.

Tests Show Resistance To Sea Water of California Cements

By THOS. E. STANTON, Jr., Materials and Research Engineer

In this article is described some long time tests by the Testing and Research Laboratory of the Division of Highways to determine the resistance to sea water of cements of the type used in construction of the San Francisco-Oakland Bay Bridge. The specifications for the Bay Bridge called for the use of special cement designed for durability. The tests proved the wisdom of these specifications and clearly demonstrated the importance of density of a concrete mix as affecting durability.

THIS paper describes some of the results of tests started in 1933 to determine the relative resistance of California commercial cements to attack by sea water.

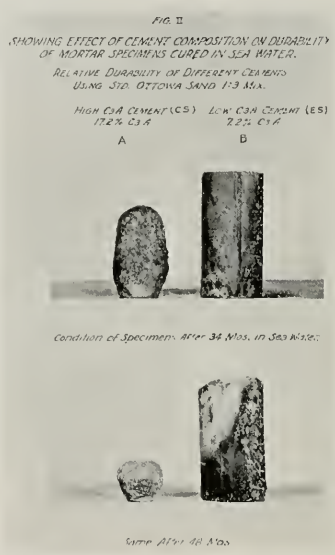
The durability of concrete exposed to sea water is governed by three factors: (a) Density; (b) Cement composition; (c) Soundness of aggregates. The aggregates used in this test were sound and highly resistant to either sodium or magnesium sulphate attack; therefore, any lack of durability is due either to low density of the mortar or composition of the cement or to a combination of low density and cement composition.

The results described herein cover a portion only of this sea water series and include cements from northern California mills only. They show rather conclusively, however, the effect of both density and cement composition.

All sea water used in these tests was secured from San Francisco Bay at the Municipal Pier, University Avenue, Berkeley. Water from the ocean opposite San Francisco has substantially the same chemical analysis as shown in Table 1. The water in which the specimens were stored was changed monthly.

TABLE 1

	Parts per million Low tide	High tide
Residue at 110° C	33304	33774
Free Ammonia—as N	.06	.08
Albuminoid	.37	.34
Carbonates—CO_3	Nil	Nil
Bicarbonates—HCO_3	142	142
Chlorides—Cl	16300	16500
Sulphates—SO_3	2403	2477
Silica—SiO_2	14	7
Iron and Alumina oxides	8	7
Lime—Ca	474	509
Magnesia—Mg	1149	1138
Alkalies, calculated—Na	9063	9308
Total hardness—$CaCO_3$	5896	5937



To test for effect of density 1:3 and 1:2 mortar specimens were fabricated using a poorly graded Ottawa sand and a well graded Russian River sand. All of the Ottawa sand graded between the 20 and 30 mesh screens whereas the Russian River sand was well graded having approximately 36% passing the 30 mesh, 20% passing the 50 mesh and 32% retained on the 10 mesh.

Following is the density of the specimens shown in Figs. I and II:

1:3 Ottawa Sand	2.018
1:2 Ottawa Sand	2.218
1:3 Russian River Sand	2.328

To test for effect of cement composition, a variety of cements were used ranging from high to low C_3A content. The results for two of these brands, one normally high in C_3A (17.2%) and one fairly low (7.2%) are shown in Figures I and II.

Complete analyses of these two cements are given in Tables 2 and 3. The remaining specimens in which the other brands were used followed identically the same trend. (Fig. III)

TABLE 2

	CS	ES
SiO_2	21.49	22.94
Fe_2O_3	2.27	2.03
Al_2O_3	7.94	4.05
CaO	63.81	65.16
MgO	1.40	1.63
SO_3	1.67	1.55
Loss	1.62	2.76
Ins.	.18	.42
Free Lime	.94	.50
C_4AF	6.9	5.8
C_3A	17.2	7.2
C_3S	32.4	59.2
C_2S	36.7	20.0
Iron Modulus	3.50	1.99

TABLE 3

	CS	ES
Specific Gravity	3.13	3.10
Fineness		
—100	99.2	99.3
—200	84.9	94.6
Surface Area	1200	1570
Normal Consistency	22.8	23.2
Soundness	OK	OK
Time of Set		
Initial	2 Hr. 30 Min.	3 Hr. 00 Min.
Final	2 Hr. 15 Min.	4 Hr. 15 Min.
Tensile Strength		
7 day	320	350
28 day	420	440

Cement ES is a standard commercial cement normally low in C_3A and not a modified cement such as the Bay Bridge low C_3A cements. Even better results have been had with the Bay Bridge cements which are lower in C_3A content (Cement BSW Fig. III).

(Continued on page 20)

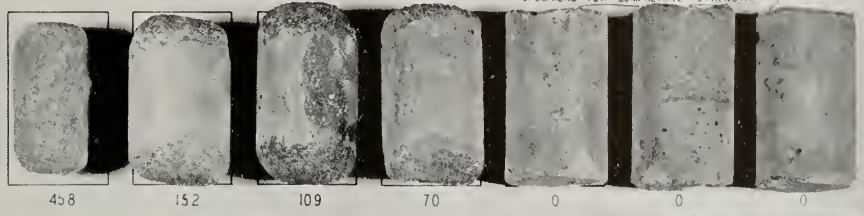
FIG. III

MORTAR DURABILITY TESTS

STANDARD UNGRADED OTTAWA SAND-CEMENT MORTAR SPECIMENS* STORED 48 MONTHS AT THE LABORATORY, SACRAMENTO, IN NORMAL CONCENTRATION SEA WATER FROM SAN FRANCISCO BAY. 1933–1937

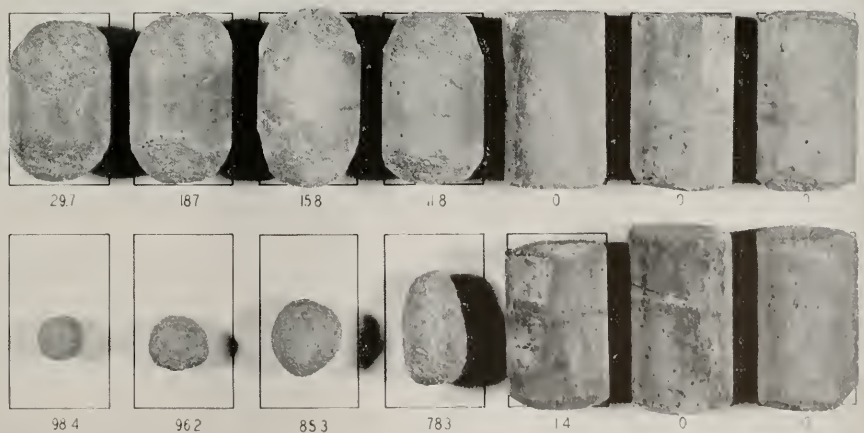
IRREGULAR EDGES RESULTING FROM REMOVAL OF CAPS ORIGINALLY PLACED WITH INTENTION OF TESTING ALL SPECIMENS FOR COMPRESSIVE STRENGTH.

MIXING WATER—FRESH



1-2 MORTAR AVE % LOSS	45.8	15.2	10.9	7.0	0	0	0
1-3 MORTAR AVE % LOSS	100	89.0	86.0	41.2	0	0	0
CEMENT IDENT	C S	D S	A S	B S	E S	BSW	DL ***
% C_3A	17.2	14.2	13.1	12.1	7.2	3.7	14.2

MIXING WATER—NORMAL SEA WATER**



1-2 MORTAR AVE. % LOSS	29.7	18.7	15.8	11.8	0	0	0
1-3 MORTAR AVE. % LOSS	98.4	96.2	85.3	78.3	1.4	0	0.1
CEMENT IDENT	C S	D S	A S	B S	E S	BSW	DL ***
% C_3A	17.2	14.2	13.1	12.1	7.2	3.7	4.1

* REPRESENTATIVE SAMPLE FROM EACH SET OF SPECIMENS

** COMPANION SPECIMENS MIXED WITH SEA WATER, BUT CURED IN FRESH WATER, SHOW NO DISINTEGRATION

*** PORTLAND-POZZOLAN, 70% STD CLINKER & 30% SILICA (COMPOUND C_3A CONTENT OF STD. PC CLINKER 7%)

Effect of Sea Water on California Cements

(Continued from page 18)

The monthly inspection of the specimens showed that at about fifteen months the upper cap (placed for compression tests at time specimen was fabricated) was being distorted and loosened from some of the specimens cured in sea water. At seventeen months the first action on the specimen proper was noticed, subsequent to which the deterioration of the affected specimens progressed steadily.

The tests described herein emphasize the equal, if not greater importance of density on the durability of concrete as the cement composition. Given a dense mix in which sound aggregate, sound cement, and a practical minimum of water has been used and concrete can be expected to resist the disintegrating effect of sea water over a long period of years, regardless of C_3A content, as is evidenced not only by these test results but also by the actual service of much of the concrete in structures in the San Francisco Bay which shows little, if any, deterioration after thirty years or more, even though cement high in C_3A was used.

As opposed to this good service record, however, we have numerous instances along the Pacific Coast where marine structures have shown severe distress in a relatively short time. Lack of density of a poorly or at least inferiorly fabricated concrete undoubtedly had a great deal to do with such failures, but cement composition was likewise undoubtedly a strong contributing factor.

Figure I shows the relative durability of variable density mixes using a high C_3A cement.



Fig. 1 Showing effect of density on durability of mortar specimens cured in sea water. Relative durability of variable density mixes using same cement High C3A Cement (CS) 17.2% C3A.

COMPARATIVE RESULT

Specimen A, a 1:3 Ottawa sand mix, had lost 98.4% of its original weight in four years, whereas Specimen C with the same amount of high C_3A cement but with a dense mortar in which a well graded sand had been used showed no appreciable loss in the same period. Specimen B in which increased density was accomplished by increasing the cement content but still using a poorly graded sand shows results intermediate between specimens A and C.

Figure II shows the effect of cement composition Specimen A (the same as specimen A in Fig. I) shows the low resistance of a 1:3 Ottawa sand, high C_3A cement mortar. Specimen B shows the greater durability of the same low density mortar in which, however, a relatively low C_3A cement was used. Specimen B lost 1.4% in 48 months as compared with 98.4% for specimen A; other 1:3 Ottawa sand mortar specimens in which lower C_3A Bay Bridge cements were used showed no loss at all at 48 months (Fig. III).

Fig. III shows the relative sea water durability of seven northern California commercial cements, six of which range from 17.2% to 3.7% C_3A; the seventh (DL_1) being a Portland Puzzolan type cement manufactured from a 14.2% C A clinker. It will be noted that the mortar from cement manufactured by the addition of 30% silica compound to a high C_3A clinker developed considerable resistance to sulphate attack. Whether this resistance developed from any puzzolanic nature of the added silica or from a denser mix is not at present known.

While theoretically all proportioning was by volume the amount required for each batch was measured by weighing. Therefore, with weight proportions fixed on the assumption

(Continued on page 27)

Elimination of Newhall Tunnel Bottleneck Soon to Be Realized

(Continued from page 10)

ground areas high up in the San Gabriel Mountains, access to which may be had at present only from the valley side.

BORE MUST GO

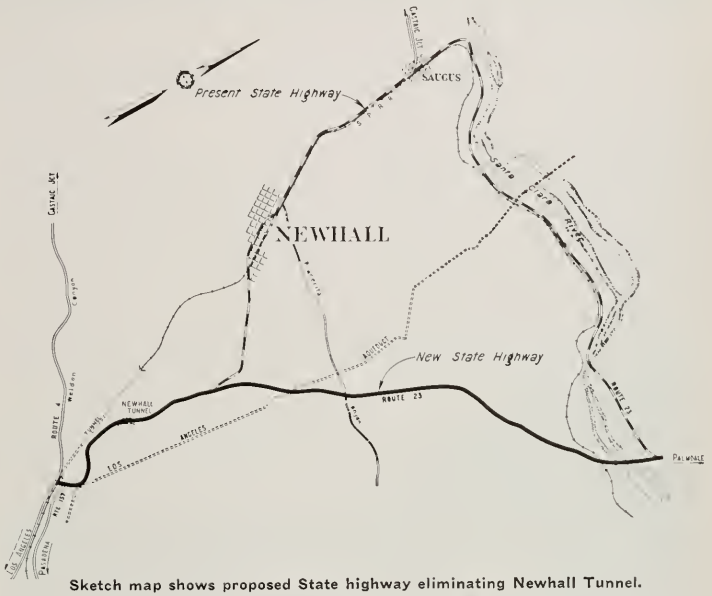
Recognizing the necessity for some sort of relief at the tunnel bottleneck, studies have been under way for some time, looking into the most logical solution from an economic standpoint of this troublesome problem. The engineering studies conclusively proved that the elimination of the tunnel completely by the construction of an open cut in place of it on approximately the same line was the cheapest and best method of carrying out roadway widening through the Fremont Pass Ridge. This, of course, will involve considerable excavation material, about 300,000 cubic yards in all, which material in turn must be disposed of in some economical manner.

Reconnaissance surveys were run in 1934 over the contemplated Mint Canyon Short Cut Route, starting from Route 23, at a point one mile north of Newhall Tunnel, to Solamint on the Mint Canyon Road, making a total saving of 4.6 miles for Mint Canyon traffic, as against using existing Route 23. As there was no nearby disposal available for the material to be removed in the Newhall Tunnel Cut, it was proposed to utilize this excess material in the best and cheapest manner by hauling it and disposing of it in roadway embankments upon the Mint Canyon Short Cut Route.

SAVING IN GRADING

Handling the excess waste material from the tunnel cut by this procedure will be of considerable advantage to the State, resulting in an economical disposal, and in a large saving of excavation grading quantities on the New Mint Canyon Short Cut Route.

It is proposed to advertise for bids shortly, calling for the reconstruction of Route 23 from the Weldon Canyon Road, through the Newhall Tunnel Cut, and for the construction of the first section of the Mint Canyon Short Cut Route as far as Placerita Canyon, all in one contract. This



Sketch map shows proposed State highway eliminating Newhall Tunnel.

work is to be financed from the budget for the 89th-90th fiscal years, the Major Project Allocation for Construction from the State Highway Fund, Preliminary South, is as follows:

LA-23-H Newhall Tunnel 0.4 Mi. Gr. & Pav.	$215,000
LA-23-H Newhall Tunnel to Mint Canyon Cut-Off 1.0 Mi. Gr. & Pav.	65,000
LA-23-I 1 Mile North of Newhall Tunnel to Solamint 5.6 Mi. Gr. & Pav., Bridges & Grade Separation	550,000
LA-23-H Tunnel Sta. to Newhall Tunnel 0.9 Mi. Gr. & Pav.	70,000
Total	$900,000

WIDE ROADBED

The design of the new roadway calls for the grading of a roadbed to a width varying from 48 feet to 64 feet. Over existing portions of Route 23 the latter graded width will prevail, upon which will be placed a combined Portland cement concrete pavement and plant-mixed surfacing 50 feet wide. This portion of the new highway also will be constructed with a central longitudinal dividing strip to separate the opposing lanes of traffic, in accordance with latest highway design standards. The contemplated pavement for the new Mint Canyon Short Cut Route is plant-mixed surfacing 33 feet in width.

The California Division of Highways has recently adopted a new standard of construction for State highways, providing for an increased width of traffic lane. In conformity with this new standard, the basic eleven foot minimum width lane will be included in the new construction.

On the present alignment of Route 23, there are many curves of sharp radii, the minimum radius being 366 feet. The alignment of the rerouting to Solamint Junction will contain two curves of a minimum radius of 800 feet, and one curve of a minimum radius of 1000 feet, with all the remaining curves being 2000 feet radius or over.

OLD AND NEW ROUTING

From the following tabulation, a direct comparison can be made between the old and new routing of Route 23, between Tunnel Station and Solamint Junction.

The new location will eliminate two grade crossings of the Southern

(Continued on page 28)

HIGHWAY STATIONS LANDSCAPED

By E. S. WHITAKER, Assistant Landscape Engineer

IN THE last several years an important feature of the establishment of new Maintenance Stations and of District Headquarters has been the landscaping of their surrounding grounds. Particularly at district headquarters, because of their urban location, where the building design has been influenced by the locale every effort has been made to complement that design with an appropriate planting.



Delightful garden of Highway Maintenance Station at Oceanside, landscaped by Mrs. E. G. Brassington

In Eureka, where the district headquarters simulates the appearance of old Fort Humboldt, the features of the landscaping are beautiful beds of rhododendrons and azaleas, both of which are native to the northern redwood belt.

IN DISTRICT V

In San Luis Obispo, District V headquarters is styled in the early California type of architecture. The whole countryside is alive with legends and steeped in the lore of that early phase of California's development and the selection of this type of design was most fitting.

The building has been nestled in a mass of trees and shrubs, in which the palms, toyons, and California sycamores are used to enhance the effect of the building design. Thus California's Christmas berry; the ragged, wind-swept crown of the palm; and the beautiful, sprawling tree which so picturesquely adds to the appeal of southern and central California's arroyos and creek bottoms, are blended into the background, placed to soften the glare of sun on white walls and to highlight the charm of low tiled roofs.

IN DISTRICT XI

District XI has appropriately fashioned its headquarters, in San Diego, after the Spanish, and the severe lines of the building's exterior are accentuated by a formal planting of shrubs and by rows of palm trees. Inside the patio, however, flowers and shrubs bloom in a year-round wild mass of riotous color. Hibiscus, poinsettia, Mesembryanthemum croceum, tuberous begonias, roses—all add profusely to the picture, so that the exotic effect of the true Spanish patio is obtained.

At a great many maintenance stations this type of work has also been carried out, especially where location, climate, and surrounding conditions tend to make landscaping desirable. The landscaping of these stations is accomplished, as at the district headquarters grounds, under an approved plan and with maintenance of the planting performed by highway groundsmen and flower gardeners.

In maintenance stations that are



Another view of Oceanside Maintenance Station in District XI.

landscaped and maintained in this manner, appearance is nearly always a matter of the District's responsibility and the individual does not enter the picture other than as a resident of the dwelling. However, there are a great many maintenance stations which were established years ago and which, either because of their location at points removed from the main highway or because existing conditions did not warrant the planting of the grounds, were never improved by landscaping. Many of these stations are used only for the storage of equipment and material. At others, residences are used by Maintenance Foremen or Superintendents, and any development has been due to the innate desire of the occupant to have a home.

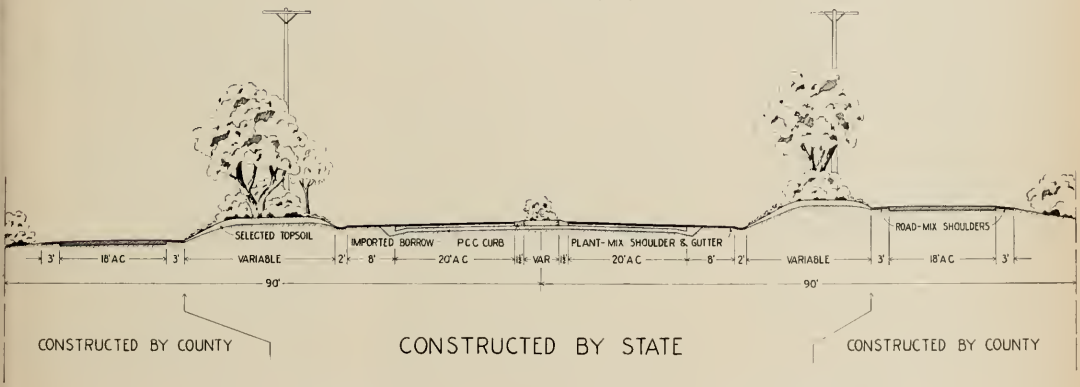
One of the most beautiful of this type has been created by Mrs. E. G. Brassington, wife of Ed Brassington, Maintenance Foreman at Oceanside, in District XI. The station is located off the highway, backed up against the railroad tracks, and in former years, while kept in a neat and clean condition, looked exactly like what it was, a store yard for maintenance materials. However, when Mr. Brassington took unto himself a wife, a remarkable change occurred on the old homestead. Now the visitor (and a visit is well worth while) will appreciate the work that Mrs. Brassington has accomplished in turning the small corner surrounding her home into a garden, which this last summer won first prize at a contest for beautiful gardens.

There are passion vine and honeysuckle on the fences; columbine, snapdragons, roses, ferns, gardenias, and begonias in the gardens; strange fruits such as Adriatic figs and Sapotes; garden furniture under a gay striped awning; stepping stones to an outdoor fireplace in one corner, and to the neat domicile of Ruby, the somewhat ancient, fat, lovable dog. And the lawn is one of the finest specimens of creeping bent lawn to be seen off, or on, any golf course.

With little help, and less official encouragement, Mrs. Brassington has created a beautiful and liveable outdoor recreation room. She has turned a maintenance station from a place of mere existence into a beauty spot and is to be congratulated on her efforts and achievements.

HIGHWAY ADDS TO MONTECITO CHARM

(Continued from page 3)



Typical section of recently completed triple roadway through Montecito showing types of highway built by State and county.

foot pavement lane. Shallow plant mixed gutters were provided for side drainage. The area between the gutters and the county-constructed side roads was filled in with selected top soil, and generally to a higher elevation than the surface of either road. This area will, at the proper season, be planted with shrubbery to supplement the existing shrubbery and trees which were carefully preserved during construction operations.

One creek crossing necessitated the construction of three bridges, one by the State and two by the county for each of their separated side roads. Specially designed massive wooden railing was used on all three bridges to conform with the general landscaping effect.

Thanks to much study on the preliminary plans, no special difficulties were encountered during construction, this phase of the work being under the supervision of J. C. Adams, State Resident Engineer.

Owing to the fact that all of the reconstruction was carried on during the dry season and further to the cooperation of the Contractor, J. E. Haddock & Co., of Los Angeles, traffic suffered very little inconvenience during construction.

Due to this same cooperation on the part of the contractor an excellent job resulted which, because of its unique character, will be closely observed by highway builders, and it is predicted will prove to be a highly satisfactory type of construction where like conditions prevail.

When a pedestrian crosses the street nowadays, he hopes to get the brakes.

A man with a big wart on his chin dropped into a doctor's office to have it removed. When he failed to return for additional treatments, the doctor phoned him to ask how the wart was getting along. "Just fine" replied the patient. "My face is gone, but the wart is still there."

Highway Bids and Awards for the Month of December, 1937

INYO COUNTY—Between 1.5 miles west of Bishop and Bishop, about 2.0 miles to be graded and surfaced with road mix surfacing. District IX, Route 76, Sections B,Bis. Triangle Rock and Gravel Co., San Bernardino, $22,548; Young and Son Company, Ltd., Berkeley, $20,801. Contract awarded to Basich Bros., Torrance, $15,433.70.

INYO COUNTY—Between 4.75 miles east of Panamint Sink and Death Valley National Monument, about 2.9 miles to be graded and penetration oil treatment applied thereto. District IX, Route 127, Sections G,H. Triangle Rock and Gravel Co., San Bernardino, $32,152; Minnis and Moody, Los Angeles, $32,846; Young and Son Company, Ltd., Berkeley, $35,044; A. S. Vinnell Co., Alhambra, $38,282; Isbell Construction Co., Reno, Nev., $43,532; John Rocca, San Rafael, $44,836. Contract awarded to Silva and Hill Construction Co., Glendale, $31,855.

KERN COUNTY—Between one mile north of Grapevine Station and 10 miles south of Bakersfield, about 19.1 miles to be graded and paved with asphalt concrete. District VI, Route 4, Sections A,B,C. Daley Corporation, San Diego, $594,302; Heafey-Moore Co. & Fredrickson and Watson Construction Co., Oakland, $595,693; Union Paving Co., San Francisco, $483,625; Fredericksen & Westbrook, Lower Lake, $486,055; David H. Ryan, San Diego, $493,871; Hanrahan Co., San Francisco, $526,453; Metropolitan Construction Co., Los Angeles, $535,790; D. W. Thurston, Los Angeles, $537,935; Gibbons and Reed Co., Burbank, $541,186; Basich Bros., Torranee, $555,446; United Concrete Pipe Corporation, Los Angeles, $519,216; Oswald Bros., Los Angeles, $482,346; Olaf Nelson, Logan, Utah, $549,236. Contract awarded to Griffith Co., Los Angeles, $461,075.09.

LOS ANGELES COUNTY—At the intersection of Firestone Boulevard and Santa Fe Avenue to be paved with asphalt concrete and drainage structure to be constructed. District VII, Route 174, Sections B,S,Gt. Dimmitt and Taylor, Los Angeles, $21,419; G. O. Gartz, Los Angeles, $18,172; L. A. Paving Co., Los Angeles, $20,178; C. O. Sparks and Mundo Engineering Co., Los Angeles, $20,955; George R. Curtis Paving Co., Los Angeles, $17,908; The Contracting Engineers Co., Los Angeles, $19,325; Vido Kovacevich, Long Beach, $19,408; Tomei Construction Co., Van Nuys, $19,767. Contract awarded to Griffith Co., Los Angeles, $17,676.50.

MERCED COUNTY—An undergrade crossing under the tracks of the Southern Pacific Company at Livingston consisting of a steel girder track span on concrete abutments and pier to be constructed and approximately 1.9 miles of roadway to be graded and paved with Portland cement concrete. District X, Route 4, Section Lvin,D. John Rocca and Claude C. Wood, Stockton, $237,014; Eaton and Smith, San Francisco, $274,489; Metropolitan Construction Co., Los Angeles, $245,922; Heafey-Moore Co. & Fredrickson & Watson Construction Co., Oakland, $254,586; N. M. Ball Sons, Berkeley, $249,321; C. W. Caletti & Co., San Rafael, $267,903; J. F. Knapp, Oakland, $233,820; J. E. Haddock, Ltd., Pasadena, $258,715; Griffith Company, Los Angeles, $251,699; Fredericksen & Westbrook, Lower Lake, $238,602; Earl W. Heple, San Jose, $234,083; Union Paving Co., San Francisco, $251,250; Gibbons & Reed Company, Burbank, $270,130; John Strona, Pomona, $256,006; A. Teichert & Son, Inc., Sacramento, $245,782; United Concrete Pipe Corporation, Los Angeles, $271,162. Contract awarded to Louis Biasotti & Son, Stockton, $215,872.75.

ORANGE COUNTY—Between Bitter Point and North Arm of Newport Bay, about 2.4 miles in length, drainage structures to be constructed, ditches to be excavated and road approach to be graded and penetration oil treatment applied thereto. District VII, Route 60, Sections A,B,NptB. Sully-Miller Contracting Co., Long Beach, $35,487; C. R. Butterfield-Kennedy Co., San Pedro, $32,771; Oscar Oberg, Los Angeles, $35,136; G. O. Gartz, Los Angeles, $28,799; Claude Fisher Co., Ltd., Los Angeles, $37,-331; J. E. Haddock, Ltd., Pasadena, $37,-404; George R. Curtis Paving Co., Los Angeles, $28,978; The Contracting Engineers Company, Los Angeles, $29,487; Vido Kovacevich, Los Angeles, $29,879. Contract awarded to Dimmit and Taylor, Los Angeles, $26,480.

SAN LUIS OBISPO COUNTY—At Harmony Creek and Pennington Creek, about 0.2 mile to be graded and surfaced with plant-mixed surfacing on crushed rock base and reinforced concrete culverts to be extended. District V, Route 56, Sections C,D. R. R. Bishop, Long Beach, $13,930. Contract awarded to L. A. Brisco, Arroyo Grande, $8,483.

SANTA CRUZ and SANTA CLARA COUNTIES—Between Inspiration Point and Los Gatos, about 6.3 miles to be graded and surfaced with roadmix surfacing on crusher run base. District IV, Route 5, Sections B & C. Ralph A. Bell, San Marino, $1,298,671; Harold Blake, Portland, Oregon, $962,192; Hanrahan Co., San Francisco, $986,288; Union Paving Co., San Francisco, $1,047,280; Granfield, Farrar and Carlin, San Francisco, $916,136; Mittry Bros. Construction Co., Los Angeles, $1,091,245; A. Teichert and Son, Inc., Sacramento, $1,096,893; Metropolitan Construction Co., Los Angeles, $1,097,264; D. W. Thurston, Los Angeles, $1,127,294; The Utah Construction Co., San Francisco, $1,274,761; Macco Construction Co., Clearwater, $895,686; United Concrete Pipe Corp. and D. McDonald, Los Angeles, $943,754; Fredericksen and Westbrook, Lower Lake, $947,138; J. E. Haddock Ltd. and Crowe Bros. Construction Co., Pasadena, $1,288,-250; Guy F. Atkinson Co., San Francisco, $1,142,771. Contract awarded to Heafey-Moore Co. and Fredrickson & Watson Construction Co., Oakland, $895,045.14.

SHASTA COUNTY—An undergrade crossing under the tracks of the Southern Pacific Railroad about one mile south of Redding and about 0.79 mile of roadway to be graded and paved with Portland cement concrete, crusher run base and road-mix surfacing. District II, Route 3, Section A. John Rocca and Claude C. Wood, Stockton, $164,069; Earl W. Heple, San Jose, $164,-330; C. W. Calletti & Co., San Rafael, $174,-249; Poulos and McEwen, Sacramento, $177,314; A. Soda and Son, Oakland, $191,-099. Contract awarded to N. M. Ball Sons, Berkeley, $163,551.55.

"Do you know what I think of married life?"

"Are you married?"

"Yes."

"Yes."

Vandals Punished For Attempts To Kill Highway Trees

Vandalistic efforts of a group of property owners along the recently completed El Cajon Boulevard in San Diego to destroy eucalyptus trees bordering that beautiful thoroughfare met with prompt legal retribution.

Three men, residents in a block on the north side of the boulevard, were arrested by the district attorney at the instigation of the San Diego grand jury, convicted and given suspended sentences. Two of the offenders, R. J. Warner and K. F. Bennett, confessed that they had bored holes in a number of trees and poured acid into the tree trunks. They also admitted to driving copper nails into the trees, encircling the trunks. They implicated S. D. Archer as the ringleader of the plot.

The attempt to destroy the trees was discovered in time to repair the damage. The city superintendent of parks had the holes cleaned and filled with asphalt and the nails withdrawn.

The investigation was conducted by Thomas Frost of the district attorney's office and convictions obtained by him.

FEDERAL AID NEEDED

(Continued from page 9)

Summarized briefly, however, the proposed legislation would apparently mean a loss to California of $8,000,000 in the current biennium and $4,000,000 per year thereafter. The cancellation of the $8,000,000 for this biennium would mean taking out of our current budget projects in this amount.

Even under the present Federal allocation, while the motorists of California pay approximately $15,000,000 per year in Federal gasoline taxes alone, we receive slightly more than one-half of this amount in return for highway purposes. If the return to the States for road building is further reduced then as a matter of fair dealing the one cent Federal gasoline tax should be reduced or repealed.

The California Highway Commission at its December meeting adopted a resolution appealing to Congress to abandon the proposal to curtail Federal aid funds for highways and to seek other means to achieving the economic objectives sought.

Storm Damage to Highways Is $2,340,875

(Continued from page 13)

U. S. 395—Standish to Secret Valley.

The new construction between Standish and Litchfield suffered severely. Besides badly scoured shoulders, some 800 feet of fill was washed away and a new structure was seriously undermined.

Across Secret Valley where heavy damage was expected, somewhat less than 1000 cubic yards of shoulder scour occurred.

U. S. 99-E—Chico to Red Bluff.

Convergence of swollen Sierra streams was responsible for the flooding of tremendous valley areas. The high velocity of the flood waters washed out fills at Deer Creek and Mill Creek, and undermined concrete pavement.

U. S. 299—Redding to Alturas.

Damage to highway fills was excessive in the vicinity of Ingot. Cow Creek swollen by cloudburst rains tore out banks until passage over the road became impossible. Three detours were quickly made passable soon after the storm subsided. At other locations, the flood waters had eaten away at the roadway embankments until only a one-way width remained. A schoolhouse and six dwellings were swept away between the highway and the creek in the town of Ingot.

State Route 28—In Cedar Creek Canyon west of Cedarville.

With previous records broken, Cedar Creek laid waste the recently constructed highway in the lower two miles of the canyon. Carrying a tremendous amount of debris, culverts were rendered ineffective and the stream picked out new channels with disastrous results for the highway.

U. S. 299—Junction City to Big Bar.

As in so many other cases during the same storm, the Trinity River topped all records for high water. And here again highway fills suffered and will need extra protection when replaced.

State Sign Route 20—Between Ukiah and Colusa County.

Floodwaters of Cold Creek and East Branch of the Russian River scoured fills. Tributary streams washed out the entire roadway and flood waters in the vicinity of Upper Lake undermined drainage structures and damaged embankments. Near the Abbott Mine a very large fill was entirely washed out, which will cost nearly $10,000 to replace.

State Sign Route 28—Navarro River Road to the Coast.

Dry Creek Bridge was washed away and required a temporary structure to carry traffic until the new highway and bridge now under contract will be completed. Mud slides and scoured embankments were prevalent on that portion of the route in Sonoma County.

U. S. 101—Redwood Highway.

Heavy erosion from the Eel River occurred south of Scotia. The Russian River between Cloverdale and Hopland eroded the toes of slopes causing roadway settlements. Pieta Creek washed out the approach fill south of the bridge.

State Route 108—Between Mission San Jose and Livermore.

The Arroyo del Valle Bridge was seriously undermined.

State Sign Route 152—West of Gilroy.

The center pier of the Uvas River concrete bridge was badly undermined, damaging the structure beyond repair.

State Highway 129 and 132.

The Kaweah River overflowed its banks and undermined the bridge near Lemon Cove. About 1000 feet of shoulder was badly scoured and the concrete pavement undermined.

State Sign Route 180—Near Minkler.

Nearly 500 feet of approach fill at the Kings River Bridge was washed away for a depth of from 4 to 5 feet.

Where Credit Is Due

Within a period of three days, the unprecedented storm of last month left in its wake wrecked highways and bridges, a toll of damage that represents a loss to the State of more than two million dollars. The monumental task of clearing flood debris from highways, repairing bridge structures and restoring traffic became overnight the responsibility of the Maintenance Department of the Division of Highways.

To the men of the highway maintenance crews in the storm-stricken areas belongs the credit for the promptness with which closed roads and bridges were opened to travel. These men labored in rain and sleet for two days and nights on emergency work, without sleep or rest that traffic might go through. They have carried on without complaint since then.

Truly, the maintenance crews have performed a task of herculean proportions and I extend to each and every one of them the appreciation and gratitude of the Department of Public Works.

EARL LEE KELLY
State Director of Public Works

ENGINEER'S SON WINS BIG JOB

Mr. T. A. Bedford, Senior Highway Engineer, Bureau of Surveys and Plans at Sacramento headquarters, recently received the cheerful news that his engineer son, Clay Bedford, 34 years old, has been appointed general superintendent for the Interior Construction Company, low bidder for raising the Grand Coulee Dam in Washington to its ultimate height, a job that will require four years and result in the largest dam in the world.

Holidays Raise Traffic on Bay Bridge Slightly

THE Christmas holidays brought an increase in daily and total traffic for December on the San Francisco-Oakland Bay Bridge, according to a monthly traffic report filed by State Highway Engineer C. H. Purcell.

Total December vehicular traffic was 723,281 with a daily average of 23,332, bringing the number of vehicles crossing the span since it opened to 10,444,609. Total earnings last month were $380,919.60. November's total vehicular traffic was 699,229 with a daily average of 23,308 vehicles.

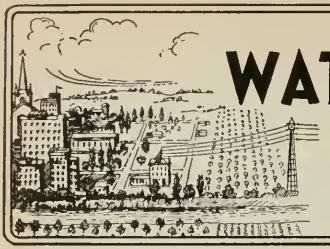
Low point last month was 17,905 vehicles on December 9, a severely stormy day. High point was Christmas Day, when 37,883 vehicles used the bridge. The three-day Christmas holiday alone produced 100,519 vehicles for the span, the largest comparative holiday period the bridge has experienced.

"Traffic for December," Mr. Purcell said, "showed an increase over the anticipated quota of as many as one thousand cars a day. A succession of foggy weather during the month, which caused many motorists to take the bridge rather than the ferries, was another factor in the increase of traffic."

Comparative figures are as follows:

	December	November	Total since opening
Total passenger autos	681,506	657,901	9,929,027
Total auto trailers	856	954	17,516
Total motorcycles	2,077	2,220	36,317
Total tricars	977	913	9,102
Total trucks	26,236	25,918	327,105
Total truck trailers	954	1,233	22,457
Total buses	10,675	10,090	103,085
Total vehicles	723,281	699,229	10,444,609
Total extra passengers	189,480	179,178	2,226,078
Total freight lbs.	59,671,837	62,451,501	748,196,020

Teacher: "What is a myth?"
Pupil: "A little moth."



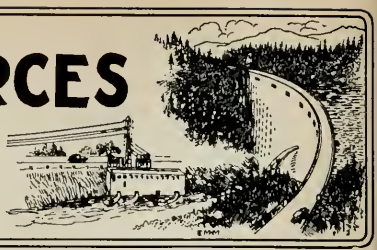
DIVISION OF WATER RESOURCES

OFFICIAL REPORT

FOR THE MONTH OF

December, 1937

EDWARD HYATT, State Engineer



THE Division of Water Resources, representing the Water Project Authority of the State of California, has continued cooperative work in connection with the Central Valley Project under an agreement with the U. S. Bureau of Reclamation.

Announcement was made by the Bureau of Reclamation during the month that a tentative agreement had been reached with the Southern Pacific Company whereby that company will perform the physical work of relocating its line around Shasta Reservoir with funds provided by the Federal Government. Work on this portion of the project is expected to start soon. The government camp at Friant Dam was practically completed during the month and work was continued on the construction of the government camp for the Shasta Dam. Work was also continued on surveys and the preparation of plans for various units of the project and announcement was made that calls would be issued soon for bids for the construction of another section of the Contra Costa Canal and for a railroad tunnel at the Shasta Dam site to by-pass the present Southern Pacific line during early construction work on Shasta Dam.

IRRIGATION DISTRICTS

Inspection was made during the month of work in progress in the West Side, Naglee-Burk and Banta-Carbona Irrigation districts, where improvements on canal systems are being made.

West Side District has resumed construction on a concrete conduit to replace an open irrigation canal running through the city of Tracy.

Naglee-Burk District has under way the preparation of plans for trimming and lining with concrete approximately two miles of irrigation canal to prevent seepage losses. Work will be in progress by the first of the year.

Oroville-Wyandotte District received W. P. A. approval of a $65,000 project for improvement which will include construction of an office building and reconstruction of flumes on the Palermo Ditch. In the last six years the district has replaced 8000 feet of old wooden flume with steel and concrete structures.

Anderson-Cottonwood District has received approval of an additional loan from the R. F. C. for the purpose of refunding outstanding bonds of the district. The previous offer of $282,000 has been increased to $339,000, equivalent to 30 cents on the dollar of bonded debt.

SUPERVISION OF DAMS

Application for approval of the Reese Dam owned by Winona V. Simmons, Redding, California, situated on a tributary of Tadpole Creek in Shasta County was received on December 8, 1937.

Application for approval of the Round Mountain Dam of the Camarillo State Hospital, Camarillo, on Long Canyon Creek in Ventura County was received on December 16, 1937.

Application for approval of plans for repair of the Lake Wohlford Dam of the Escondido Mutual Water Company, Escondido, situated on Escondido Creek in San Diego County was approved on November 30, 1937.

WATER RIGHTS

Twenty-seven applications to appropriate water were received during November; 2 were denied and 32 were approved. The rights were confirmed under 4 permits during the month and 11 were revoked.

Inspection reports are in the course of preparation covering projects which were investigated during the recent field season and during November 426 reports were received from permittees and licensees, which reports are under study for the purpose of determining appropriate action.

SACRAMENTO-SAN JOAQUIN WATER SUPERVISION

Field data gathered during the summer months is being assembled to show the diversions, acreage irrigated, stream and return flows in the Sacramento and San Joaquin valleys.

The sampling of water in the delta for salinity is being carried on at all regular stations to record the retreat of the salinity.

During the past month abnormally heavy rains caused a rapid rise in the Sacramento River and consequent flooding of the by-pass areas and low lands and in some instances, by breaks in the levees, reclaimed land.

CALIFORNIA COOPERATIVE SNOW SURVEYS

With all arrangements completed in the field for the 1937-38 snow surveys, the past month has been devoted entirely to work in the office.

Monthly precipitation records for the period since last May are being checked. All tabulations and curves necessary to our forecasting procedure are being brought up to date.

FLOOD CONTROL AND RECLAMATION

Maintenance of Sacramento Flood Control Project

At the commencement of this period, the stages in the flood channels were at medium height, due to the storm which commenced on November 19th. Patrols were maintained on the new levee from Butte Slough to the Colusa County line on the east side of the Sacramento River, and minor repairs were made. The pumping plants east of the Sutter By-pass were in operation practically during the entire period covered by this report.

A new storm occurred from December 9 to December 12, inclusive. This resulted in high stages in all flood channels, which made it necessary to patrol the levees day and night for about five days. During the period our crew was increased to about 140 men and, in addition, about 60 relief laborers were employed.

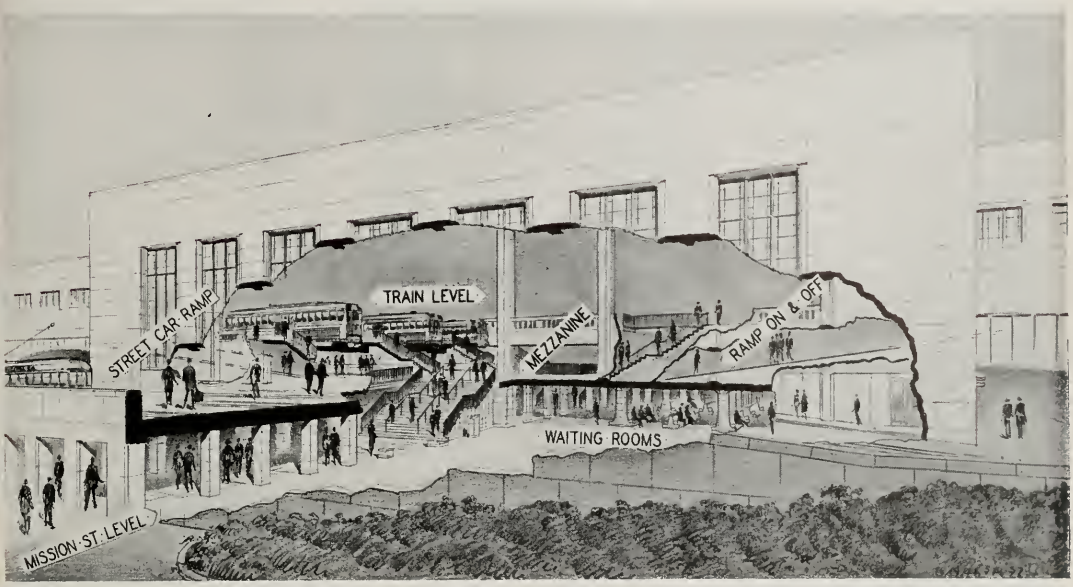
Relief Labor Work

During the recent storm, relief labor was employed under an emergency project for patrol and emergency protective work. This project is sponsored by the Department of Public Works and crews were used on the American River Flood Control District, Levee District No. 1, by-pass levees, and the Colusa levees. About 100 men were so employed. This includes a crew of 25 men from the S. R. A. Transient Camp No. 7 in Sutter By-pass, which was employed continuously at various places.

Damage to Levees

The unusual high stage reached at many points during this flood resulted in a number of levee breaks on the Sacramento River above Colusa and on the Feather and Bear rivers. A complete survey of the damages caused by the flood has not yet been completed.

Bay Bridge Terminal To Be Ultra Modern



THIS "cut away" drawing of the San Francisco Terminal of the San Francisco-Oakland Bay Bridge railway facilities shows how passengers traveling to and from the East Bay points will reach their destinations in the structure, now under construction. Electric trains will come in on the upper level over six tracks entirely enclosed within the building. To reach street cars from the trains, passengers can either take short ramps or brief flights of stairs leading directly from the train platforms to the mezzanine. Street cars loop over a viaduct in front of the terminal building at the mezzanine level. To reach the street level, passengers leave the mezzanine by means of a flight of stairs. Waiting rooms and concessions are on the street level. Information and ticket offices are on the mezzanine.

At no time will passengers cross the tracks to reach, or depart from, their trains; but will utilize the stairs or ramps leading from the train platforms to the concourse below.

Highway Inventory

(Continued from page 5)

plus approximately one-third of the motor vehicle fees and a federal aid apportionment for expenditure on our rural highways. This 1½ cent tax at the present time yields approximately $22,000,000 annually.

The State's share of the Motor Vehicle Fund is approximately $3,000,000 and federal aid is approximately $4,500,000, making a total of $29,500,000. Of this amount, a minimum of $12,500,000 is needed for maintenance, administration, engineering, and rights of way, leaving only $17,000,000 available for construction and reconstruction projects with which to overtake the procession of increasing rural traffic demands.

The above represents only the essential highlights in the survey of our present day status. There are certain other items not mentioned wherein California could improve its service to the modern motoring public. Notably among these services is the question of making our highways more pleasing in appearance.

Although roadside beautification may not be deemed a traffic service necessity, nevertheless it does contribute a vital part in developing traffic and is an important factor in helping to relieve the high nervous tension of our present day life.

STATE BUYS MORE SNOW PLOWS

(Continued from page 4)

Arrangements have also been made for a daily broadcast of road, weather and snow conditions on all State highways in the Sacramento territory, which will be released at 9.50 a.m. over Radio Station KFBK. This service began on November 27, and is expected to continue throughout the balance of the snow season.

EFFECT OF SEA WATER ON CALIFORNIA CEMENTS

(Continued from page 20)

that all cement was of uniform specific gravity, approximately 25% more by volume of the low specific gravity high specific surface Portland Puzzolan cement was used in each specimen than of the normal specific gravity cements.

The results illustrated in Fig. III indicate that the durability is affected to a much greater extent by the storage water than by mixing water when both mixing and storage waters are similar to San Francisco Bay water.

Assistant Bridge Engineer Murray Becomes Colonel

THE Bridge Department of the Division of Highways now has a full-fledged Colonel in its personnel.

Assistant Bridge Engineer Edward Jackson Murray of the Sacramento headquarters staff on October 1 was promoted from lieutenant colonel, California National Guard, to the rank of colonel, succeeding Col. Charles R. Blood, who retired in order that his subordinate officers in the 184th Infantry might obtain well earned promotions to higher grades.

Col. Murray enlisted in Co. G, 2d Infantry, California National Guard, on April 25, 1914, in Sacramento. He served with that unit as a private, corporal, sergeant and 1st sergeant until June, 1916. He was commissioned second lieutenant in his regiment June 19, 1916.

SERVED OVERSEAS

Service on the Mexican border at Nogales, Arizona, from June 26 to November 16, 1916, followed. While on the border, Colonel, then Lieutenant, Murray was attached to the 12th U. S. Infantry.

On March 25, 1917, Murray was called into Federal service again, promoted to 1st lieutenant and served with the 2d Infantry of the National Guard at Richmond, California, and for a time was assistant recruiting officer in San Francisco. In September, 1917, Murray was assigned to Co. G, 160th Infantry, at Camp Kearny and went overseas as 1st lieutenant with that outfit.

While in France he attended Air Corps Observation Schools at St. Maixent and Tours and the Artillery School of Fire at Camp Coetquidan. He served as first lieutenant and captain, Infantry Reserve, until March, 1924, when he was commissioned captain of infantry in the National Guard and was assigned to the 184th Infantry as plans and training officer. He was promoted to major in May, 1926, and to lieutenant colonel in April, 1930. He has commanded the regiment since October 1.

Col. Murray entered into state service with the Division of Highways on April 1, 1924.



COL. E. J. MURRAY

Elimination of Newhall Tunnel Bottleneck

(Continued from page 21)

Pacific Railroad at Newhall and Saugus, respectively. A grade separation structure will be constructed at the crossing of the Southern Pacific Railroad on the new line, near Solamint Junction. Future plans also include the construction of a reinforced concrete bridge at Placerita Canyon.

	Existing	*Proposed*
Length in miles	12.67	7.25
Minimum radius in feet	366	800
Number curves less than 1000′ radius	13	2
Total number curves	35	15
Total degree curvature	1,119	452
Total length curves feet	21,323	18,467
Width roadbed feet	36	48

Economically, the construction of the Mint Canyon Short Cut is sound, paying the public, in the form of savings in operation costs, large returns each year. These savings in cost of operation of present day average traffic by the shorter distance will amount to approximately $240,000 per year, which savings will be sufficient to pay the total estimated cost of construction of the new line in less than two and one-half years.

Floods Cause Huge Damage

(Continued from page 16)

by the Division of Water Resources and submitted immediately after the first of January 1938.

The following table giving a preliminary estimate of the damages caused by the storm and flood of December 10-13, 1937, was prepared by the Division of Water Resources in response to this request.

The State Division of Highways, Parks, and Fish and Game; county officials, supervisors, clerks, engineers, farm advisors and agricultural agents; the Reclamation Board; the United States Engineering Corps; U. S. Weather Bureau; the National Forest and Park services; and the various public utilities gave willing and active cooperation in furnishing the data on which this report is based. It was only by this splendid cooperation possible to assemble the data for this estimate in the time allotted.

January 1, 1938.

Preliminary estimate of damages resulting from storm and floods of December 10-13, 1937, based on a survey of the entire State during the period December 20-31, 1937. Estimates are tentative and subject to considerable revision as more accurate data are received.

Railway systems	$620,000
Highways, roads and streets	4,510,000
Telephone and telegraph systems[1]	no report
Gas and electric systems	360,000
Irrigation and domestic water supplies	370,000
Improvements, homes, and industries in cities	1,650,000
Industries in rural areas	170,000
Summer camps, homes, and resort equipment	610,000
National, State, and city parks or forests	510,000
Farm buildings, fences, and equipment	1,530,000
Livestock	500,000
Field crops and produce in storage	1,350,000
Orchards and vines[2]	90,000
Channel erosion and debris removal	1,670,000
Levees and other protective works	630,000
Total	$14,570,000

[1] Reports of Western Union and Postal Telegraph Co's. showed less than $5,000 damage. No report was received from the Pacific Telephone & Telegraph Co.

[2] Damages to orchards and vines from prolonged flooding of root systems will not become apparent until next summer.

STATE OF CALIFORNIA

Department of Public Works

Headquarters: Public Works Building, Twelfth and N Streets, Sacramento

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HARRY A. HOPKINS.....Assistant Director

EARL LEE KELLY.....Director

EDWARD J. NERON.....Deputy Director

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J. G. STANDLEY, Principal Assistant Engineer
R. H. WILSON, Office Engineer
T. E. STANTON, Materials and Research Engineer
FRED J. GRUMM, Engineer of Surveys and Plans
C. S. POPE, Construction Engineer
T. H. DENNIS, Maintenance Engineer
F. W. PANHORST, Bridge Engineer
L. V. CAMPBELL, Engineer of City and Cooperative Projects
R. H. STALNAKER, Equipment Engineer
E. R. HIGGINS, Comptroller

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F. W. HASELWOOD, District II, Redding
CHARLES H. WHITMORE, District III, Marysville
JNO. H. SKEGGS, District IV, San Francisco
L. H. GIBSON, District V, San Luis Obispo
R. M. GILLIS, District VI, Fresno
S. V. CORTELYOU, District VII, Los Angeles
E. Q. SULLIVAN, District VIII, San Bernardino
S. W. LOWDEN (Acting), District IX, Bishop
R. E. PIERCE, District X, Stockton
E. E. WALLACE, Disrict XI, San Diego

SAN FRANCISCO-OAKLAND BAY BRIDGE

C. E. ANDREW, Bridge Engineer

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A. D. EDMONSTON, Deputy in Charge Water Resources Investigation
R. L. JONES, Deputy in Charge Flood Control and Reclamation
GEORGE W. HAWLEY, Deputy in Charge Dams
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EVERETT N. BRYAN, Hydraulic Engineer Water Rights
GORDON ZANDER, Adjudication, Water Distribution

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P. T. POAGE, Assistant State Architect
W. K. DANIELS, Assistant State Architect

HEADQUARTERS

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C. H. KROMER, Principal Structural Engineer
CARLETON PIERSON, Supervising Specification Writer
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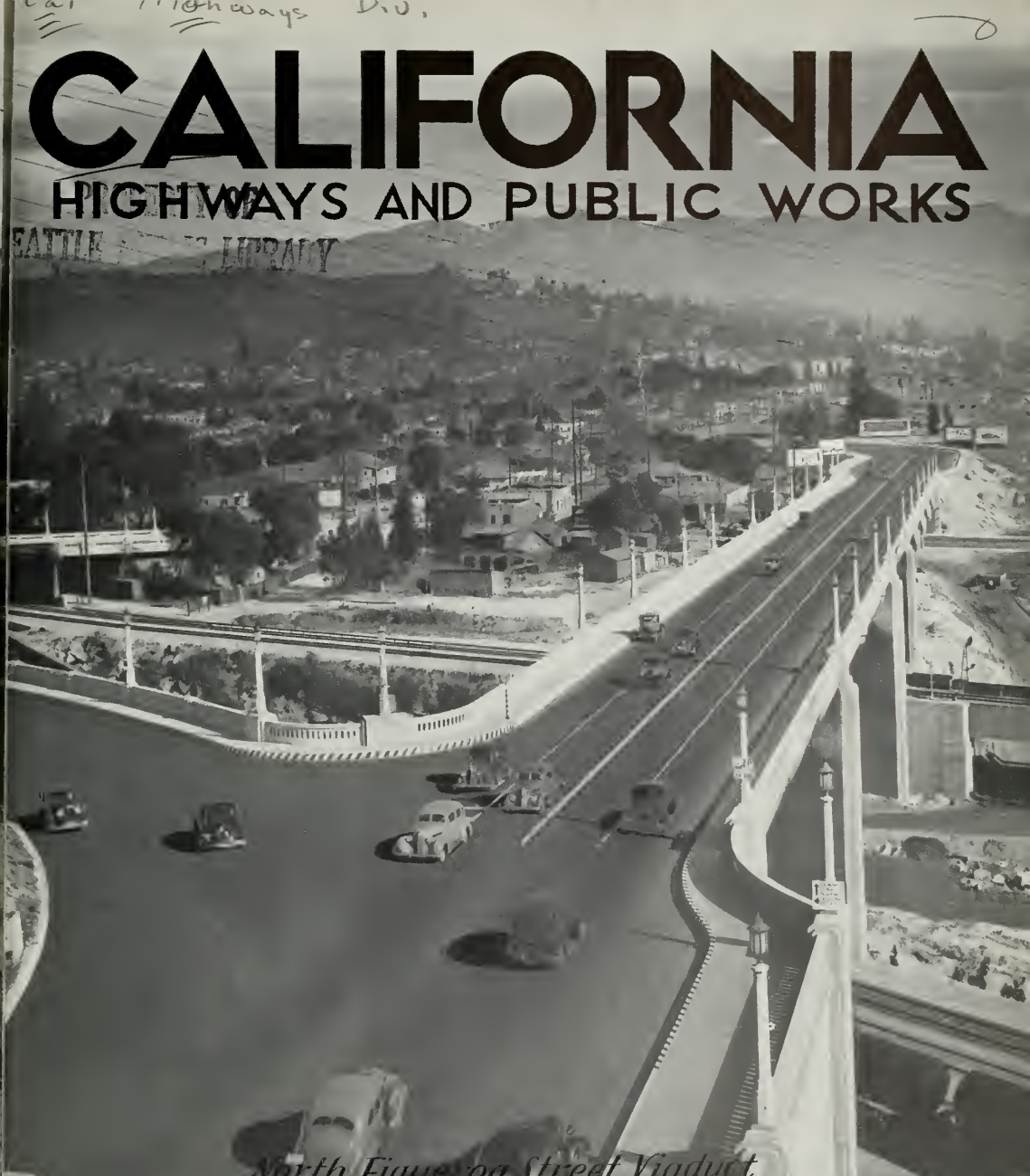
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Official Journal of the Department of Public Works

FEBRUARY · · 1938

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways of the Department of Public Works, State of California

EARL LEE KELLY, Director C. H. PURCELL, State Highway Engineer JOHN W. HOWE, Editor K. C. ADAMS, Associate Editor

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STATE PROPERTY OF

California Must Spend Many Millions in Order to Keep Pace With Traffic Demands

Highway System Inadequate For Needs of Today

By C. H. PURCELL
State Highway Engineer

INTO the midst of the present furor over the proposal before the Congress to drastically reduce the Federal Aid Appropriation for highways, let us introduce and consider the present condition of the State highway systems of the various states. If there be any basis whatever for a reduction in highway expenditures, it must rest upon the premise that adequate highway facilities are now in existence throughout the nation.

The actual facts make any such an inference incredible.

For instance, reliable information proves that obsolescence, inadequacy and depreciation render at least half of the 14,000 miles in the highway system of California incapable of safely and satisfactorily serving the traffic they now bear, and conditions in California are neither better nor worse than the other States of the Union.

For proof let us examine the extent of completion of the system in this State point by point.

SOME VITAL QUESTIONS

Has California a complete and adequate network of major roads with no further need for reconstruction due to tortuous and dangerous alignment, excessive grades, or obsolescence?

Is there no further necessity for widening narrow and hazardous widths to safely accommodate the large buses, trucks and other commercial vehicles using our highways in conjunction with an ever expanding traffic?

Are all of our antiquated roads, originally located by oxcart methods, satisfactorily relocated to the required modern standards of safety in width, grade and curvature?

Have all dangerous crossings at grade with railways and important highways been provided for?

Have by-passes been provided around every important metropolitan community to avoid and mitigate the attendant traffic congestion?

Is every bridge on the State highway system of ample width and load carrying capacity to adequately serve even the present traffic to which it is subjected?

AND THE ANSWER IS "NO"

The answer to this series of questions by any well informed citizen of this State is, of necessity, an emphatic, "No!"

As a matter of fact none of these objectives has been realized, nor is there any reasonable possibility of their attainment in the near future, especially if there is any curtailment of highway finances, which even now are proving inadequate for the task.

It may help to convey some conception of the magnitude of the problem facing the highway authorities of this State, if we consider the current estimated cost of modernizing our present highway system.

At the present writing, statistics indicate that approximately 4600 miles of the present system should be rebuilt immediately to adequately and safely handle the traffic to which those roads are subjected.

It is estimated an expenditure of $100,000,000 will be required for this purpose.

Traffic figures further indicate that about 1200 miles of the present system should be widened to provide divided

(Continued on page 12)



Intersection of U. S. 99E with Southern Pacific Railroad in Roseville. Such traffic blockades as this are frequent.

Progress on Highways

By GEORGE T. McCOY, Assistant State Highway Engineer

THE RECENT inspection trip through the east and midwest undertaken by a group of engineers from the Division of Highways in connection with their attendance at the 1937 convention of the American Association of State Highway Officials in Boston was valuable in its revelation of the progress being made in the solution of highway problems.

Each of these engineers made a written report of his observations. The consensus of opinion revealed by these reports is that while California can justly be proud of her State highway system, nevertheless from the standpoint of all around traffic service, this State does not lead the procession in modernization of highway facilities and much is to be learned from the progressive achievements in other States.

While in Massachusetts the group saw about 200 miles of the Massachusetts highway system. The trip included the new North Shore Divided Highway north of Boston, some of the roads around Lexington and Concord and a section of the Worcester-Boston highway.

Of particular interest is the new North Shore Highway, of which all Massachusetts engineers are justifiably proud. It will eventually connect with more adequate facilities the metropolitan area of Boston with that of New York, if the other two states, Rhode Island and Connecticut, across which it will pass, follow the same standards of construction.

All important road intersections are designed with a modified clover leaf type construction which greatly reduces traffic congestion at those points.

An appreciable mileage of divided roadway with frequent grade separations of intersecting roads has helped materially in reducing the congestion previously experienced on the main turnpikes radiating from Boston. The use of a wide division strip was particularly noticeable. On most of these recent improvements dividing strips



GEORGE T. McCOY

of from 20 feet to 30 feet in width have been used. These are bordered by flat sloping curbs and the attractiveness of the entire road is enhanced by the grass-sodded and planted strips and side slopes.

MASSACHUSETTS HIGHWAY SYSTEM

The most noticeable features of Massachusetts' recent construction are extensive use of a patented, bituminous pavement and almost exclusive use of granite curbing. The pavements of this patented type have an extremely harsh surface with about the same riding quality as the most severe of the non-skid work placed on our Sacramento-San Francisco road in the vicinity of Dixon.

The granite curbing is used on both sides of the dividing strip, the only concrete curbing being the precast white cement curbing used on the noses of the strip.

NEW YORK IMPRESSIONS

Leaving Massachusetts after the convention, they spent one day with the New York Highway Department, during which time they saw the new Express Highway in New York City and about 200 miles of Parkway on Long Island.

The most impressive thing about the trip over New York highways was the boldness reflected in the location, design, and cost of the work. Great sums of money have been spent for beautification on the Parkways, all of which have an extremely wide right of way, usually about 600 feet.

From their observation and contacts, the group concluded that the New York authorities, both political, administrative, and engineering, and the people of the State in general have been more thoroughly educated to the problems of highway transportation in the vicinity of a great metropolis, than is found either in the middle west or on the Pacific Coast, even though the problems of highway transportation and vehicular movement are very similar in New York, Chicago, Los Angeles and San Francisco.

New York, by its construction of bridges, tunnels, elevated roadways and parkways is certainly far ahead of any other city or State visited on the trip in solving highway transportation problems.

COMPLICATED JOB

Mr. Robert Moses, Commissioner of the Department of Parks of the City of New York, assigned the engineer in charge of the job to escort our group over the west side improvement project which required a reclamation of 132 acres of land, with an assessed valuation of $23,760,000.

Mr. A. W. Brandt, Commissioner of Highways of New York State, accompanied them on the tour.

This project demanded the practical rebuilding of an entire railroad system, the only all-freight route into Manhattan, elevating it in certain sections, depressing it in another, and covering it in a third by an express highway for motor traffic.

It involved also the development of



Part of the West Side Improvement project along the Hudson River in New York City, showing Riverside Drive Park and shoreline in the foreground connecting with the elevated West Side Express Highway which extends along the waterfront from 72d street almost to the southern end of the city.

Riverside Drive into one of the finest parkways in the nation.

The project calls for a "nonstop" highway from the Battery at the tip of Manhattan to Westchester County. Only at strategic points can this highway be entered, featured by separated grade crossings. This route runs almost its entire length directly along the Hudson River.

IMPRESSIVE ACHIEVEMENT

The Riverside Parkway alone from 72d Street to Dyckman Street is 6.7 miles in length and has 34-foot separated roadways, with six grade separation structures. It has a maximum grade of 4 per cent and a 2000-foot minimum radius of curvature on the main highway. There is a minimum vertical sight distance of 500 feet.

The entire West Side highway project includes that section from the Battery to 72d Street, which comprises an elevated express highway only; the section from 72d to Dyckman Street, just below the Harlem River, which involves the Riverside Park system; and the Henry Hudson Parkway from Dyckman Street across the double-deck Henry Hudson Bridge over the Harlem River through the Bronx and into Westchester County.

The whole project constitutes an impressive achievement of planning and execution.

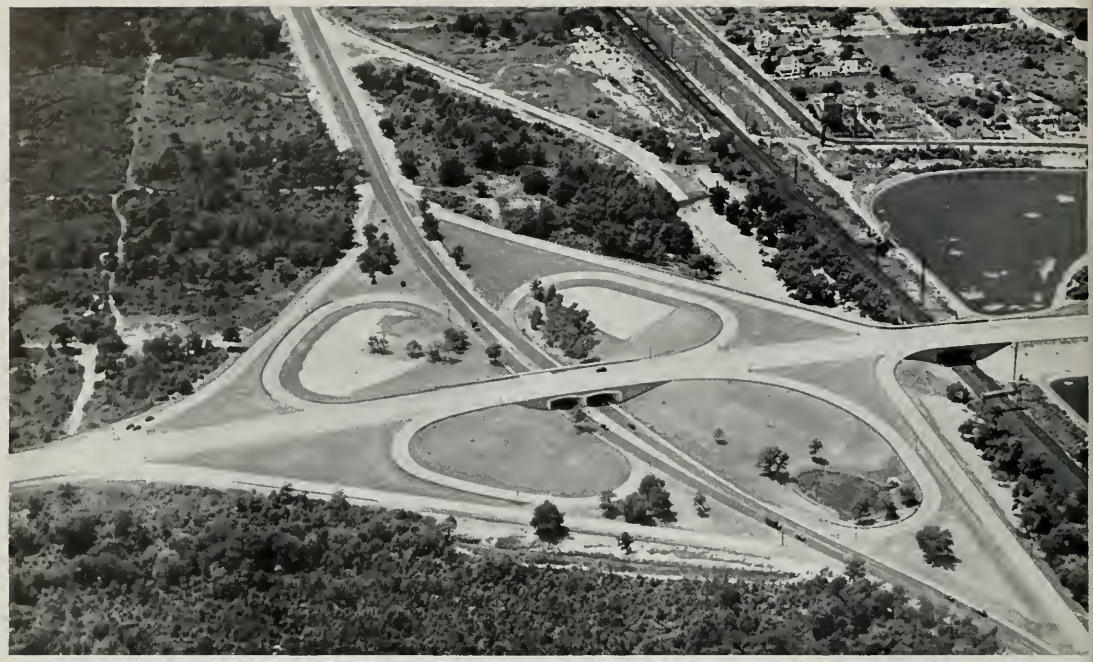
GREAT BRIDGES BUILT

The George Washington Bridge across the Hudson River, the Triborough Bridge across the East River and connecting roadways are perhaps the outstanding examples in this country of highway construction running into large costs. Enormous traffic volumes and congestion in the confined limits of Manhattan Island justify the huge expense for these improvements. They are featured by traffic lanes, separated on and off ramps, separated cross-traffic, sometimes with two and three level roadway crossings, to take care of a huge volume of traffic and permit of speedy, safe and comfortable flow of vehicles.

Without such facilities traffic would be compelled to submit to hours of delay, moving through terriffic traffic jams with their acompanying hazards.

Many bridges have been built across the East River to Long Island, some are free of tolls and on others nominal charges are made. These bridges connect to modern, high standard, divided highways with few road intersections except those of the so-called clover leaf type.

By this method of separation of the grades of two highways, the intersecting roads pass over the speedways on artistically constructed concrete arches faced with imported cut stone; the avenues of entrance into the speedways consist of accelerating lanes which allow incoming traffic to pick up speed to that of the traffic of the main highway and gradually



Clover leaf design grade separation typical of many in New Jersey by which vehicles are enabled to make turns at intersections without interfering with through traffic and congestion is eliminated.

pinch in without causing apparent congestion.

MOST MODERN DEVELOPMENT

The parkways on Long Island, which are especially outstanding by reason of their roadside development and separations from conflicting cross-traffic, permit a rapid and comfortable flow of traffic from the residential communities of Long Island into the main city, and to recreational facilities and extensive public beaches in this area.

Our engineers had one day in New Jersey, leaving New York through the Holland Tubes going south over New Jersey's Skyway and over U. S. No. 1, New Jersey's Route No. 25, to New Brunswick, returning on State Routes through Bound Brook, Plainfield, Elizabeth, and the Oranges to the George Washington Bridge.

In New Jersey the most outstanding construction feature is the large number of grade separations where important highways intersect, the most elaborate being the intersection of Routes 2 and 4 just east of Arcola. This intersection combines long "Y" connections with an inner clover leaf design.

FINE DIVIDED ROADWAYS

New Jersey also has some very fine examples of divided roadways, provided with an unusually large number of openings in the dividing strip which seem in a way to offset to a large degree the safety sought for.

The highway department is now using a minimum width of 22 feet for the dividing strips and is thinking of adopting 35 feet as a minimum. On all of the 22-foot strips, curbing is provided on both sides; while on the 35-foot separation such as Route 23, the curbing has been omitted. The State is now experimenting with a new fluted faced reflecting type curb and has just recently awarded the first contract for a 20-mile installation.

In discussing the divided roadways with Mr. Giffin, State Engineer of Surveys and Plans, he expressed the conviction that the width of the divided strip should either be sufficient to be of practical benefit as a safety zone in covering the turning or crossing vehicle or drop to a minimum of four or six feet, and that little was to be gained by intermediate widths of, say, ten or twenty feet. The State engineers have also concluded that the 4-lane divided roadway for rural roads represents the ultimate in efficient operation and that rather than add additional lanes, new parallel routes should be constructed.

PARALLEL ROAD TREND

The tendency in highway construction in New Jersey leans toward a policy different from that encountered in any other State visited or from that now in general use as applied to California. Where modern 20-foot pavement has reached a point of saturation, from the standpoint of traffic, intersections and constructed roadside activities, such as market centers, etc., their general plan seems to be to allow this road to exist as it is and to construct a parallel highway.

A four-lane divided section is used on the new alignment where the problems of intersections can be more

easily solved and right of way costs, as far as the readjustment of existing facilities is concerned, are not prohibitive.

MICHIGAN VISITED

From New Jersey the group went to Michigan and viewed the famous Wayne Conuty concrete road construction in the vicinity of Detroit. Wayne County lays claim to being the originator of concrete road construction. The multiplication of this type of highway has been prolific. Portland cement concrete is the Michigan standard type of pavement construction, but very few sections have the oiled or surfaced shoulders now standard construction in the West.

Two planes were brought down from Lansing and our little delegation was flown to the upper peninsula across the Straits of Mackinac where the Michigan Highway Department hopes to eventually build a bridge connecting the upper and lower peninsulas of the State.

BROAD HIGHWAYS

Ample width of right of way secured years ago on some of the main traffic arteries radiating from Detroit, permitting comprehensive and satisfactory expansion of the highway of both divided and undivided types, was perhaps the outstanding feature of some of the highways visited in Michigan. This pertains especially to roads in the immediate vicinity of Detroit and lying within Wayne Conuty.

An interesting and attractive example of fitting a highway into the landscape, and of developing the roadside with native material, is the Lakeshore Road on the upper peninsula of Michigan running westerly from St. Ignace along the northerly shore of Lake Michigan.

SERVICE TO MOTORISTS

In Michigan are some of the oldest divided roadways seen on the trip, some of them having been in service for ten to fifteen years.

The Michigan Highway Department is paying more and more attention to service to motorists in the way of road information and roadside picnic and rest facilities. This is particularly true in the northern half of the State where a large per cent of the traffic is recreational. The highway department has spent a considerable amount of money in developing the roadside parks in this area.

In Chicago the group stopped one day for a trip over the new Chicago-Milwaukee road just being completed by the States of Illinois and Wisconsin. This is a high type divided road with a 30-foot dividing strip and in Illinois has been curbed on both sides, while in Wisconsin the curbing has been omitted.

CHICAGO'S LAKESHORE DRIVE

Confronted with a situation similar to that of New York, Chicago has developed the Outer Drive or Lakeshore Drive, consisting partly of an elevated roadway and of a divided parkway with side service roads.

Observing the movement of traffic on this six-lane road, on which traffic lights are so arranged and coordinated as to permit unobstructed and uninterrupted flow for considerable distances, caution is impressed against expansion which runs into too many lanes. Observations would indicate that efficiency is considerably reduced and hazard increased.

Throughout this eastern trip and particularly in the States of Massachusetts, New York, and New Jersey, the most noticeable feature to the visitors from California was the excellent appearance of the highways, even though close observation indicates less attention to maintenance. This is

(Continued on page 27)



Numerous grade separation structures like the above provide safe traffic movement on the New York Parkway systems in city and suburban areas. The overpass bridges are built of steel and faced with imported cut stone blocks.

Highway Accomplishments in California in 1937

By RICHARD H. WILSON, Office Engineer

CONSTRUCTION and maintenance operations of the California Division of Highways are based upon budgetary set-ups for biennial periods of two fiscal years.

The present biennium, including the 89th and 90th fiscal years, began July 1, 1937, and extends to June 30, 1939. Thus, the calendar year of 1937 was composed of the closing six months of the biennium including the 87th and 88th fiscal years and the first quarter of the current biennium.

The total for construction projects placed under way during the calendar year does not represent normal activities for any one fiscal year for both the closing quarter of one biennium and first quarter of a new biennium are usually under the average for the other quarters as, in one instance, the work consists of getting under way the few remaining projects of a biennium and in the other case unavoidable uncertainties tend to delay early progress in advertising projects for bids.

MILLIONS FOR HIGHWAYS

Even under these conditions, however, the construction and maintenance activities of the California Division of Highways during the calendar year of 1937 amounted to $29,217,600 in contracts awarded and work orders approved for day labor in improvement to the State's highways.

Of this figure, $19,509,900 was the cost of contracts and day labor construction put under way during the year and financed from State and federal funds. Financing this work required $12,921,400 in funds allocated to the Division of Highways from the State's gasoline tax and motor vehicle registration fees and $6,588,500 in funds on which reimbursement will be had from federal moneys apportioned to California.

The $6,588,500 in federal funds consists of regular Federal Aid, Works Program funds, Grade Crossing and Feeder Roads funds for the fiscal year ending June 30, 1938.



RICHARD H. WILSON

SEGREGATION TO FUNDS

Segregation to the various funds from which the money for the $19,509,900 in construction has been allotted is shown in the following summation:

Regular Federal Aid for fiscal years ending June 30, 1937 and 1938	$5,003,800
Works Program Highway funds	563,700
Federal Grade Crossing funds for fiscal year ending June 30, 1938	934,800
Federal Feeder Road funds for fiscal year ending June 30, 1938	86,200
State highway fund	12,921,400
Total	**$19,509,900**

The total amount of construction and maintenance placed under way between January 1, 1937, and December 31, 1937, and provided for under the total of $29,217,600 is divided to the various classes of the Division's activities as follows:

Construction and reconstruction	$19,509,900
Maintenance	9,557,700
Maintenance and Operation of San Francisco-Oakland Bay Bridge	150,000
Total	**$29,217,600**

CONSTRUCTION PROGRESS

Progress of construction activities in improvement to the State highway system, which provided for a total of 1,212 miles of highway graded, surfaced, paved or oiled and 50 bridges and grade separations constructed, is shown in the following tabulation giving the type of improvement together with the mileage for each type:

Type of Improvement	Miles
Pavement	126
Plant-mix surfacing	174
Road-mix surfacing	99
Oiled Gravel Surfacing (arm- or coat, etc.)	438
Untreated gravel or stone surfacing	2
Graded roadbed	30
Dust Oil roadbed	179
Shoulder construction or oiling	164
Bridges and Grade separations	(50)
Miscellaneous contracts	----
Total	**1,212**

The type designation in the above tabulation gives the kind of surfacing on the completed improvement and in each instance includes the necessary grading required for any given project. In certain cases the grading and drainage structures have been the major portion of the projects, but the improvement has been included under the surface type.



Type of highway built last year. Looking south from new Santa Margarita River Bridge in San Diego County showing new forty-foot asphalt concrete pavement.

Listed shoulder improvements include contracts which involved work on shoulders only.

June 30, 1937, marked the close of the budgetary biennium for the 87th-88th fiscal years and July 1st the beginning of the current biennium including the 89th and 90th fiscal years and during the closing six months of the last biennium contract construction in the amount of $3,830,500 practically closed out the available funds from that and preceding biennial periods.

CONTRACTS SPEEDED

On May 4th, the State Legislature adopted and the Governor approved the budget, and on May 10th, the first contract to be financed from funds provided for the current biennium was awarded by the Director of Public Works. The Division of Highways was so well prepared to immediately advertise for bids projects which were to be financed under the budget for the current biennium that by July 1st contracts in the amount of $2,248,900 had been awarded.

This activity in placing construction contracts under way has been continued during the past six months to the end that by December 31st contracts amounting to $10,154,100 and financed from budgeted funds for the current biennium, federal grade crossing and feeder road funds had been awarded.

It is hoped that construction activities on State highways will continue at this rate during 1938. However, should Congress comply with the recommendations of the President that Federal Aid apportioned to the States for highway improvement during the fiscal year ending June 30, 1939, be canceled, the construction activities of the Division of Highways would be curtailed by some $8,000,000.

ALTAMONT PASS

In regard to the construction placed under way during 1937, the following brief descriptions are given of a few of the larger and more important improvements.

In Alameda County, construction on improved alignment of the State highway connecting Oakland and the bay area with Stockton and the upper San Joaquin Valley via the Altamont Pass was begun early in the summer and is progressing rapidly.

The project has involved some of the heaviest grading ever undertaken by the State, including the movement of nearly 2,000,000 cubic yards of earth in the excavation of the roadway and necessitating about 30,000,000 stations yards of overhaul. The new routing of this heavily traveled arterial lies to the south and east of the existing highway, is about 8.4 miles in length, and will provide four lanes of bituminous treated rock surfacing with the opposing lines of traffic separated by a curbed dividing strip four feet wide.

GRADE SEPARATIONS

In the construction of this new route it has been necessary to provide four grade separations, two each with the tracks of the Southern Pacific and Western Pacific Railroads. Two of these separations are accomplished by a single overhead structure near the westerly end of the project at Greenville. The second separation with the Southern Pacific Railroad is an overhead crossing at Redmond and the second with the Western Pacific Railway is a subway at Stone Cut. The central dividing strip is carried through the three structures.

The construction of this project is one of the most important improvements made to the State highways in Northern California in recent years and its completion will eliminate from the State system the narrow, tortuous route of the old road through the Altamont Pass on which traffic congestion has greatly increased in recent years. It is estimated that the cost of this improvement, including the grade separations will amount to about $1,200,000.

CUESTA GRADE PROJECT

Another heavy grading job in connection with the revision in alignment of a main artery is the project involving the reconstruction of the Coast Route at the Cuesta Grade about six miles north of San Luis Obispo. Here again, the widening of the crooked two lane highway was found to be impracticable and a new routing is being constructed on the southerly side of the canyon.

The new road will provide for four lanes of bituminous rock surfacing with opposing traffic ways separated by a curbed dividing strip and curvature standards designed for modern trunk highways. It will be 3.3 miles long, extending from San Luis Obispo

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CONCRETE PAVEMENT SLAB WARP AND ITS PREVENTION

By C. S. POPE, Construction Engineer

This is the first of two articles dealing with highway concrete pavement distortion and measures for its prevention and relief which have been prepared by C. S. Pope, Construction Engineer of the Division of Highways. The second installment will be published in the March issue of California Highways and Public Works.

DURING 1932 a Portland cement concrete pavement was constructed between Williams and Maxwell on a foundation of some twelve inches of bank run gravel.

On completion the pavement presented a smooth and pleasing riding surface, but within a few weeks time a noticeable roughness became apparent which became so pronounced as to be the subject of inquiry by Director of Public Works Earl Lee Kelly.

Investigations were undertaken by the Materials and Research Laboratory at the request of the District Office and the Construction Department. A rather complete report by Assistant Testing Engineer O. J. Porter indicated the following conditions:

LABORATORY REPORT

1. The subsoil over which the gravel blanket had been laid showed high shrinkage and swell when subjected to loss or additions of moisture.

2. The gravel blanket itself was composed of material not entirely free from changes in volume following changes in moisture content.

3. Expansion joints which had been placed across the pavement at intervals of about 60 feet were imperfectly sealed against the infiltration of rain water.

4. The moisture content of subsoil and of gravel blanket under expansion joints greatly exceeded the normal moisture content under the mid-point of paving slabs.

5. The ends of slabs at expansion joints had raised from ½ inch to 1 inch due to expansion of the underlying soil—the amount of expansion varying with the percentage of moisture.

Mr. Porter found that by introducing water at the mid-point of slabs through core holes drilled through the slab to equalize moisture content in the subsoil at all points under the pavement, and by resealing the joints effectively, the surface of the pavement gradually returned to a true plane.



Compacted imported borrow removed to show membrane seal intact.

During the investigations by the State of the Williams pavement, the Portland Cement Association undertook a cooperative investigation of paving warp on a much wider scale. This investigation included California, together with the States of Kansas, Missouri, Minnesota, and Texas, and the writer became the California representative on the general committee reporting to the National Research Board. The reports submitted by the various States included written matter, diagrams, drawings, and photographs comprising several hundred pages.

CONCLUSIONS OF STUDY

The conclusions arrived at in the California study constitute the subject matter of this article and are as follows:

A. Soil or Other Conditions Which Prevent or Cause Warping

1. Warping on sandy subgrades is practically negligible.

2. Warping on silty subgrades is usually dependent upon the amount of clay in the silt and on its ability to absorb water.

3. Warping is most severe on clay type or plastic soils (such as adobe in California) which are known to be of an expansive nature and which at the time of surfacing with paving have a moisture content so low that it may be readily increased through leakage at the joints. (See Figure 1 on page 23.)

B. Causes of Warping

1. Warping of concrete pavement slabs as indicated by high joints has been caused by swell of sub-soil in a zone extending about 5 feet each side of expansion or other through joints. Tests indicate that increase in moisture content of subgrade of as little as 5 per cent between that found under the center of the slab and that found under the zone adjoining the expansion joint will cause a warping of the pavement of as much as ½ inch.

2. Warping of slabs is influenced by rainfall where joints are not fully waterproofed and where the moisture



These pictures show three progressive operations in laying Portland cement concrete pavement. Upper—Membrane seal in place ready for imported borrow. Center—Motor grader spreading imported borrow over membrane seal. Lower—Imported borrow in place on membrane seal ready for grading and paving operations.

content of the subgrade under the slabs varies in percentage throughout the lineal dimension of the highway.

3. Warping is often seasonal or cyclic in pavements where the admission of additional moisture to the subgrade through joints or by other means is not prevented.

C. Methods of Preventing Warping

Warping has not occurred on concrete pavements constructed in California by the following methods:

1. Designing the grade line so that highly expansive soils were either not included in the subgrade or were removed and replaced by other soil of a nonexisting nature.

(Continued on page 22)



New concrete bridge over the south overflow channel of Big Tujunga Wash.

Realignment at Sunland Completed

By P. A. McDONALD, Assistant Highway Engineer

STATE Highway Route No. 9, or Foothill Boulevard, as the name would imply, follows along the base of the mountains, starting at the city of San Bernardino, extending westerly through the foothill towns and city of Pasadena to a junction with State Routes 4 and 23 at a point just below the Newhall Tunnel at the westerly Los Angeles city limits.

It not only serves to carry through traffic from the San Joaquin Valley and points north to San Bernardino and points east, and vice versa, but forms an important part of the metropolitan Los Angeles highway system, enabling through traffic to by-pass the downtown Los Angeles traffic congestion.

Recently completed in Los Angeles city and forming an important link in that portion of the route between Pasadena and the junction with Route 4 near the Newhall Tunnel, is a section of Foothill Boulevard, between Fenwick Street and Terra Bella Street. It is 2.90 miles in length, lying adjacent to the community of Sunland, and approximately four miles northeasterly of the city of San Fernando. The new highway location effects a saving of 2500 feet over the previous distance traveled.

DANGEROUS CURVES ELIMINATED

This work, completed under two Department of Public Works contracts, consisted of reconstructing the old narrow, inadequate traveled way built in 1921 on a curving and dangerous alignment as measured against present day traffic requirements and higher speed. Two dangerous right angle turns were eliminated, and a new bridge constructed, crossing over the south or overflow channel of the Big Tujunga Wash, in addition to extensive reconstruction work in widening and utilizing the major portions of the existing bridge across the north or main channel of this wash.

Formerly this wash carried the runoff from a large area in the mountains northeast of Pasadena with resulting tremendous floods in time of heavy storm, but with completion in recent years of a flood control dam eleven miles above the highway, the possibility of future danger from heavy flows has been largely eliminated.

WASH BRIDGE RECONSTRUCTED

In addition to the two right angle turns that existed on the old traveled portions of Route 9, the old alignment at the north end of the bridge over the Big Tujunga Channel followed along a dangerous curve of 250 feet radius. Easterly of the Big Tujunga Wash the alignment of the old roadway was curving with reverse curves of 600 foot radius and limited sight distance.

The new Foothill Boulevard section provides a minimum radius of curvature of 1100 feet, with only one curve of this minimum located at the north end of the bridge over the main channel of the Big Tujunga Wash.

This structure, originally constructed by the Department of Public Works in 1921, consisted of sixteen reinforced concrete simple girder spans on mass piers and abutments, with concrete railings, and a twenty-one foot width roadway with no sidewalk. It has been extensively reconstructed, and four spans eliminated reducing the overall length by some 200 feet. The reconstructed width provides a clear 44 foot roadway with an additional 2½ foot sidewalk width.

At the westerly end of the project, junction is made with the existing Foothill Boulevard near Terra Bella Street through a curve of 1600 foot radius. Thus all sharp, dangerous, curving alignment and right angle turns are eliminated and sight dis-



Typical view of completed roadway. Big Tujunga Canyon in background.

tance improved, which conditions heretofore made this a section of highway where frequent traffic accidents occurred.

The improvement was designed and constructed in such a manner as to utilize a considerable portion of the old improvements, at the same time providing a new highway built to present recognized standards. The improvement throughout was graded to a minimum width of 60 feet increased to a width of 74 feet between curbs through subdivided land.

Where improvement follows a new location, two strips of standard Portland cement concrete pavement were placed, and where new construction follows along the old center line, the existing 15 foot Portland cement concrete pavement was improved by placing a second story of asphalt concrete.

Roadway shoulders throughout were further improved for a distance of ten feet on either side of pavement by the road-mix method.

The entire improvement was let in two contracts, one contract for grading and paving in the amount of $121,320 awarded to C. O. Sparks & Mundo Engineering Company, March 31, 1937; and the second for the construction of the two bridges in the amount of $124,900 awarded to Byerts & Dunn, on the same date as the highway contract. Work of grading and paving was completed on January 14, 1938, and the bridge work was completed January 18, 1938.

Resident Engineer A. D. Hunting of the Southern Bridge District supervised construction operations for the State under the bridge contract, and Resident Engineer W. J. Calvin of the District VII office of the Division of Highways represented the State on the highway contract.



View easterly over new bridge across Big Tujunga Wash overflow channel. Old sharply curving alignment shown to right foreground and left background of new construction.

Highways to Cost Many Millions to Make Them Safe

(Continued from page 1)

multi-lane roads. These are the major arteries of commerce of the State, and the financial problem is complicated by the expensive right of way problems and high structural standards necessarily a part of modern highways of this type.

The cost of doing this work is estimated at $200,000,000 minimum.

UNSAFE HIGHWAYS AND BRIDGES

In addition, planning surveys indicate the necessity for relocating over 1000 miles of existing highway to provide adequate standards of alignment, grade and sight distance to successfully and safely serve the ever increasing traffic needs.

It is estimated that $50,000,000 will be required for this task.

Finally, of the 3300 odd bridges upon the State highway system, careful condition surveys have disclosed that approximately 2300 are inadequate, either structurally or because of dangerous approaches or narrow widths, and should be rebuilt.

The cost of this item is estimated at $70,000,000.

Indeed, there are 400-odd bridges of the above number, so structurally unsound as to require restrictive posting for limited loads and speeds. These constitute hazardous menaces to traffic for there is always someone willing to take a chance with an overload. Too often the result of such an arrogant disregard of this restrictive warning is the collapse of an entire structure with all the attendant blockage of traffic until a new structure can be built.

HUGE FUND REQUIRED

These bridges are being replaced as rapidly as limited funds permit, but to replace or adequately repair them all would require $10,000,000.

In summary, we find that approximately $420,000,000 could economically and justifiably be spent, in this State alone, for road and bridge construction. There is not included in the above amount any sum for the construction of those highly expen-



From top to bottom—A danger spot on heavily traveled U. S. 101 near Santa Barbara. Guard rail emphasizes the narrowness of this coast connection in San Mateo County. Another impediment to smooth flow of traffic near Sunol, Alameda County. Alignment such as this is both a bottle-neck and hazard on Redwood highway near Petaluma, Sonoma County.

sive systems of elevated highways so frequently proposed for metropolitan areas, even though there may well be sound economy and merit in the suggestions. This amount represents the sum which should be spent now, to modernize our roads for present conditions, and does not constitute an attempt to estimate the cost of completing our highway system.

Since the inception of State highways in 1912, there have been numerous and repeated efforts to estimate the cost of completing the system, as of some particular period or time. Any such attempt is foredoomed to failure, for the simple reason our highway problems are not fixed and unchanging, but are as dynamic and unpredictable as the motor vehicle itself.

The bare statement that there were 77,000 motor vehicles in California in 1912, while today there are 2,600,000 odd conveys no adequate idea of the basic changes in highway design made necessary by this increase.

If the 2,600,000 autos, trucks, busses, etc. upon our highway today, were of the same weight, speed and capacity as the 1912 models, we would not have so complex a traffic and accident problem.



Left—Old "Speedway" in Venice illustrates expensive problem in road modernization. Right—Autos blocked by train on Santa Monica Boulevard.

HIGHWAY OBSOLESCENCE

That an appreciable portion of our present problem is due to obsolescence rather than depreciation can not be denied. Nevertheless, there can be no justifiable criticism upon the basis that present conditions should have been better anticipated in the highway construction programs of the past.

If a highway engineer in 1912 had been so bold as to attempt the construction of roads to present day standards of alignment, grade and width, the small mileage of construction possible from the limited funds then available would have been indefensible, for the important consideration then was "to get traffic out of the mud"; quantity instead of quality was the watchword.

The plain truth is that all forms of transportation in America have progressed at such speed in the last three decades, as to incur what might at first appear to be an overwhelming obsolescence charge. However, it may be said without fear of successful contradiction, that no highway ever built has failed to pay for itself many times over, especially if the traffic using it has become so numerous and congested as to merit its replacement with a higher type.

The railroads of this country are another form of transportational medium faced with obsolescence problems but railroad executives are in a position to prohibit the purchase of heavier engines or cars and faster passenger locomotives until the roadbed and structures have been strengthened sufficiently to successfully and safely handle the heavier loads and higher speeds. The railroad designer is also in a position to know exactly the speeds and loads for which he must design. How different from this is the lot of the highway executive and designer, who not only have little control over either the amount, the weight, or the speed of the traffic which uses the facilities they build, but who must, in addition, strive to anticipate the future designs of the motor vehicle manufacturer, who himself is unable to furnish a satisfactory and trustworthy prediction. Add the further complication of population shifts and concentrations, and the wonder is we have so small a highway obsolescence factor.

Last year, in California, it is estimated that motor vehicles traveled approximately 17 billion vehicle miles, on the State highways alone.

If each operator had paid only 3 cents per mile for this privilege, the income in that year would have amounted to $510,000,000, which is a larger sum than is estimated as required to modernize our present system.

It is estimated that the average motorist in California pays less than two mills per mile for the privilege of using the highway system.

Considering that experiments indicate a 3½¢ per mile savings between driving upon an earth road and a surfaced pavement, it would appear that highways are a pretty sound investment, and that there is ample justification for accelerating, rather than decelerating, our highway expenditures.

"Waiter, there's a splinter in my cottage cheese."

"What do you expect for a dime, the whole cottage?"

Customer—Didn't I get my last haircut in this shop?

Barber—I think not, sir. We've only been in business two years.

These Highways and Bridges Are Far Fron













(1) Section of Route 110, Tuolumne County, oxcart standards for modern traffic.

(2) Auxiliary props serve as temporary expedients to permit use of old bridge in Ventura County.

(3) Tortuous alignment emphasizes inadequacy of this road in Ventura, near Santa Paula.

(4) Little space left for stream flow by this prop supporting old truss over Jack Peters Creek.

(5) and (11) Route 20, Trinity County, large expenditures required to rebuild roads of this type to modern standards.

afe for Traffic They Are Forced to Carry





(6) Dangerous alignment and inadequate bridge on Route 198, San Diego County.

(7) Visual warning of traffic limitations on Niland-Mecca Road, Imperial County.

(8) Section in Madera County badly in need of reconstruction on south entrance to Yosemite Park.

(9) Route 17, entering Nevada City, showing constricted alignment.

(10) Emergency repairs to antiquated wooden structures of this type can not long endure.







Livingston Subway Will Abolish Dangerous Railroad Crossing

By C. J. TEMBY, District Office Engineer

CONSTRUCTION of 1.9 miles of State highway on Route 4, U. S. Highway 99, at Livingston, Merced County, including an undergrade crossing of the Southern Pacific Railroad tracks is now under way.

This improvement will eliminate the existing dangerous highway crossing of the Southern Pacific Railroad tracks at grade. The existing crossing presents a dangerous traffic condition because of poor alignment, narrow right of way and restricted visibility.

The present highway is in general parallel to the railroad right of way on either side of the crossing, making the crossing of the tracks at a skew of about 45 degrees through reversing curves, having 300-foot radii. To the south of the existing grade crossing, the present highway is routed over a city street of the commercial section of Livingston, with restricted width, which creates a traffic hazard.

HAZARDOUS CONDITION

This hazardous condition will be eliminated by construction on new alignment, starting at a point about 0.5 mile south of Livingston on Route 4 easterly from the railroad tracks, along unimproved street free of buildings or other obstructions, crossing the railroad right of way on tangent with reversing curves of 2800 feet and 1500 feet radius at south and north approach, respectively, to a connection with the existing highway 1.0 mile north of Livingston.

The undergrade crossing is on a skew of 35 degrees with the railroad tracks. The structure is 61 feet wide, having four traffic lanes 12 feet wide, two lanes each for traffic in opposite directions separated by Portland cement concrete curbs 7 feet wide. Sidewalks 3 feet wide are to be provided on each side of the subway. The curb and island separations between traffic lanes are to be extended out of the subway about 1500 feet each side of the railroad tracks.

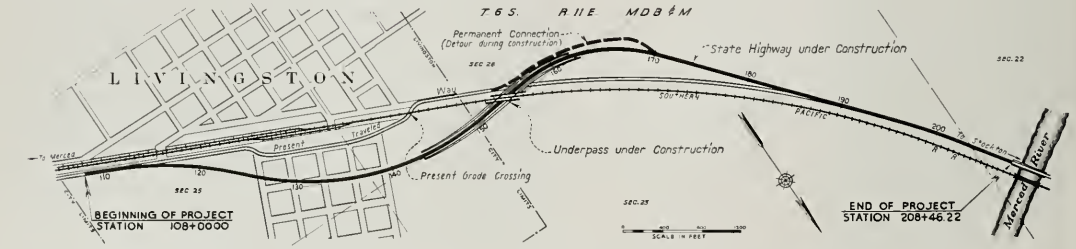
The Portland cement concrete pavement slab in the bottom of the subway is designed 36¾ inch (maximum) thick to counteract uplift resulting from hydraulic pressure of ground water. Adequate pipes are provided to drain water from the subway depression to a sump equipped with pump to boost the water to surface drains.

A main canal of the Merced Irrigation District is crossed about 350 feet south of the railroad crossing. The water in this canal will be carried across the highway in Portland cement concrete siphon.

The roadway approaches to the subway will consist of a graded roadbed 39 feet wide, and Class "B" Portland cement concrete pavement 23 feet wide, the first two traffic lanes of proposed separated four traffic lanes.

SAVING IN DRIVING TIME

The construction program requires that the Southern Pacific Railroad route trains over shoo-fly track construction to the west of existing tracks. The highway traffic will be routed over detour to be provided parallel to and west of the northerly end of the proposed work. Upon completion of the new highway, the road used as a detour during construction will be used as permanent connection to existing streets southerly to serve traffic desiring to move to or from the main section (business and residential) located west of the railroad tracks.



This sketch map shows location of present Livingston grade crossing and location of new underpass and realigned highway.

Although no saving in distance is to be effected by this construction, an appreciable saving in driving time will be made.

Grades of the subway are 4 per cent with a vertical curve 500 feet long in depression.

CHANGES IN ALIGNMENT

A comparison of the existing and proposed alignment is as follows:

	Existing	Proposed
Total length	9778′	10046′
Total curvature	198° 42′	140° 27′
Minimum radius curve	300′	1500′
Maximum radius curve	8669′	6000′
Total length on tangent	4058′	4081′
Total length on curve	5720′	5965′
Skew angle R. R. crossing	45°	35°

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This "S"-turn grade crossing hazard in Livingston, Merced County, is being eliminated. Upper view shows railroad crossing looking southerly toward Livingston and center one shows traffic blockade caused by train. Lower—Excavation for Livingston underpass. Permanent detour on right.

New Highway In Mojave Breaks Bad Bottleneck

By MERLE W. ELLIS
Assistant Highway Engineer

WITH the completion of construction through the town of Mojave on December 1, 1937, under a contract awarded to S. A. Cummings of San Diego on August 17, 1937, a previously existing bottleneck to commercial and pleasure bound traffic has been eliminated from the Los Angeles-Reno road.

Mojave is located one hundred and five miles north of metropolitan Los Angeles on the western edge of the Mojave Desert at the junction of Routes 23 and 58.

The beginning of Mojave dates back to 1876 when its present location was chosen for the site of a construction camp to accommodate workers engaged in the completion of the Southern Pacific Railroad between Los Angeles and Bakersfield.

OLD BOOM DAYS

The site of Mojave was chosen as the location for the camp by reason of its location at the eastern foot of the Tehachapi grade over the Sierra Nevadas. During the railroad construction days, Mojave flourished as a rip-roaring construction camp; but upon completion of the railroad, the population of the desert town dwindled until only few persons remained.

It was not until 1907 that the boom days of Mojave were again revived, and at that time the town was host to the scores of workers who were engaged in the construction of the Los Angeles Aqueduct. Upon completion of the aqueduct, it again dwindled to its former comatose state, existing as a division point for railroad employees, but gradually becoming better known to early motorists as a desert town on the road to Reno or Bakersfield.

In 1935, Mojave again made the front lines due to the discovery of gold at its front door. The influx of eager miners added to the density of



Upper—Main Street of Mojave in 1909. Harvey House on left. Center—Mojave, July 25, 1912, showing the only street light, a lantern placed in the square tower. Lower—Mojave December 1, 1937, after new construction. Picture taken at approximately same place as photo in 1909 was taken.

through traffic, and Main Street of Mojave became a metropolitan boulevard as far as its traffic was concerned.

Early roads to this area were of the usual dirt type, seldom graded, narrow, deep rutted, a bog during the wet seasons and a sea of flour-fine dust during hot weather. It was not until 1922, after acquisition by the California Highway Commission of the

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Trees Used For Snow Fences Are Proving Worth

By E. S. WHITAKER
Assistant Landscape Engineer

DISTRICT II this year has placed over 57,000 feet of new snow fencing, after a detailed study of prevailing wind directions and cross drafts as shown by snow drifting onto the traveled way. This new fencing, made of lath and wire, augments fences which have been in place, in some instances for many years, and has been installed at a considerable cost in the belief that man-created drifts off the traveled way are much easier to cause than naturally formed drifts on the roadway are to dispose of.

Maintenance costs on snow fencing are high, due to damage by wind and snow weight, by stock, fire, and deterioration. An ideal condition would be had if fences could be placed and forgotten, or could upon being damaged replace themselves. As this is a quality not present in inanimate material, and because plant life is to a certain extent endowed with this quality, the Maintenance Department has this year begun the establishment of rows of trees which will form shelter belts to act as snow fences.

TREE PLANTING PROBLEMS

Naturally, the planting of trees for this purpose can not be accomplished at every point along the roadsides where drafts cause snowdrifts on the roadway. There are many factors to be considered before work can be done, among them: soil conditions, or lack of soil; physical features, especially man-made, such as intersecting roads which afford long, uninterrupted sweeps of wind; cut banks which in themselves cause a back-swirl of wind force so that the burden of snow is deposited; or logged-off areas which terminate in a forest wall which deflects wind and builds up a drift; inability to secure permission to plant trees in the proper locations because of agricultural use of the land and the very permanency of the planting itself. There are places, however, where all conditions are as favorable as may be had, and at these locations trees will be planted.

The idea is not new; there are many well-established shelter belts and windbreaks throughout the country and these have been in use for snow protection in the Eastern States for years. But in California the areas with snowfall in such quantity as to

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Upper—Trees planted parallel to snow fence will form drift shelter when winds whine down from Mt. Shasta. Center—Trees planted across the front of snow fences on this sidehill. Lower—Wind carried snow up and over this hillside, causing one of heaviest drifts on the road. Six rows of trees are planted up the side of this hill.



Another highway project completed last year. El Cajon Boulevard in San Diego.

Highway Accomplishments in 1937

(Continued from page 7)

Creek at the bottom of the grade to Cuesta Siding. The cost, together with an overhead crossing over the Southern Pacific tracks near the northerly end of the project is estimated at about $861,000.

WORK IN SAN DIEGO COUNTY

Extensive improvement to the main highway between San Diego and Los Angeles was undertaken during the year between the Las Flores Underpass and the Orange County Line in northern San Diego County.

This improvement has involved four contracts and has consisted of the reconstruction of the route, with the widening of the bridge across San Onofre Creek and construction of an overhead crossing over the tracks of The Atchison, Topeka and Santa Fe Railway near San Onofre. The larger of the two road jobs consisted of constructing pavement on new alignment for eight miles between the Las Flores Underpass and San Onofre and the second paving contract provided for reconstruction on the 2.6 miles between San Onofre and the northerly boundary of San Diego County. The total cost of these improvements will be approximately $680,000.

NEW MONTECITO HIGHWAY

Another important improvement to the main coast highway includes the construction of a four lane divided thoroughfare through Montecito just south of Santa Barbara. The new section of highway through this beautifully developed community provided the construction of a planted parting strip dividing the two main traffic lanes and on each side, but separated from the main highway by landscaped parking, service roads for local traffic.

In Monterey County the State is constructing a modern bridge across the Salinas River at Soledad to more adequately care for the ever increasing traffic on the Coast Route between Los Angeles and San Francisco. This new structure will cost some $326,000.

Two improvements of interest to

(Continued on page 24)

Taft to Maricopa Highway Opens With Ceremonies

OFFICIAL dedication and opening of the new link on State Route 138 between Maricopa and Taft was celebrated on the afternoon of January 9.

If a straight line is drawn on the map of California from Oakland to Los Angeles it will very nearly coincide with Route 138 for a distance of approximately 100 miles from Maricopa to Coalinga in Kern County. For this reason, all the communities on the west side of the San Joaquin Valley are greatly interested in any improvement of this route, believing it ultimately will be accepted as the shortest, fastest and safest highway between the large metropolitan areas of the State.

OLD ROAD DANGEROUS

The old road between Maricopa and Taft was an 18-foot Portland cement concrete road originally constructed by Kern County, on an alignment which had many dangerous and horizontal curves. The average traffic of over 2000 machines daily, combined with the heavy hauling for oil field development work, made this reconstruction necessary.

When surveys for this improvement were started, the engineers of the Division of Highways were faced with the problem of getting the most direct line between the two towns that would miss all of the oil wells, with which this area is thickly studded.

For a preliminary study, an aerial survey was made, which furnished a map on a scale of 1000 feet to the inch. Using this map, the most direct possible line was secured economically without loss of time for preliminary topography. The final location has one four mile tangent and a minimum horizontal curve reduction of 2000 feet. There is one 300-foot piece of 5 per cent grade. All the other grades are 3.6 per cent or under, with long sight distances on the vertical curves. The final line makes a saving in distance of approximately three-quarters of a mile.

Specifications for grading on this road followed the California Highway standard, requiring earth



Official group at dedication of Taft-Maricopa Highway. Left to right—Judge J. R. Anderson, Maricopa; Fred Grumm, Engineer Surveys and Plans, Sacramento; R. H. Wilson, Office Engineer; Frank Balfour, Right of Way Agent, Los Angeles; Highway Commissioner W. T. Hart, Carlsbad; Fred W. Panhorst, Bridge Engineer, Sacramento; Highway Commissioner Robert S. Redington, Los Angeles; Senator Jack McBride, Ventura; Harry A. Hopkins, Assistant Director Public Works; Chairman H. R. Judah, Highway Commission, Santa Cruz; Highway Commissioner Paul G. Jasper, Fortuna; Mayor Ed Lehman, Maricopa; J. G. Standley, Principal Assistant Engineer, Sacramento; O. G. Miller and M. H. Lytle, Maricopa; L. D. Batchelder, Taft Chamber of Commerce; Supervisor Stanley Abel, Taft; Miss Maryalyn Anderson, left, and Miss Mary Lou Miller of Maricopa were ribbon holders.

work to be spread and rolled in 8-inch layers, but since this is in a dry area, water was not needed in construction of fills below the top two feet.

In addition, a special provision was written which eliminated the requirement of a roller in case the contractor elected to move his earth with tractors and pneumatic tired carry-all equipment, and also provided that such equipment should spread the material in layers not to exceed 4 inches in thickness before compaction, and route the equipment uniformly over the full width of the embankment.

Approximately 200,000 yards of embankment were placed by the contractor in this way. The value of this method was demonstrated by the fact that compaction tests on completed embankments in every case gave results of over 100 per cent as against the 80 per cent minimum required in the specifications.

The contract was carried out by the Griffith Company of Los Angeles, which completed this work one month in advance of the schedule.

Supervisor Stanley Abel of Kern County was master of ceremonies at the dedicatory celebration held at a point on the highway midway between Taft and Maricopa. Assistant Director of Public Works Harry A. Hopkins formally opened the highway by severing a ribbon held by the Misses Maryalyn Anderson and Mary Lou Miller of Maricopa. On the evening before the dedication, a banquet was served by the Taft Chamber of Commerce and the Maricopa Exchange Club in Taft, complimentary to the California Highway Commission and the engineers of the Division of Highways.

Present at the ceremonies of dedication were some two thousand citizens of Kern County, Highway Commissioners Robert S. Reddington of Los Angeles, W. T. Hart of Carlsbad and Paul Jasper of Fortuna, and the following officials of the Division of Highways: George T. McCoy, Assistant State Highway Engineer; J. G. Standley, Principal Assistant Engineer; R. H. Wilson, Office Engineer; Fred J. Grum, Engineer of Surveys and Plans; F. W. Panhorst, Bridge Engineer; L. V. Campbell, City and Cooperative Engineer; and R. M. Gillis, District Engineer.



View of recently dedicated Taft-Maricopa Highway looking southerly in direction of Maricopa.

Trees for Snow Fences Will Save Money in Future

(Continued from page 19)

entail considerable expense for removal, to maintain traffic flow, are generally located in a forest or, at least, a wooded area. Forests and trees in natural habitats are an evolution and have become of size through a relatively slow process, and planted trees under these conditions will also be slow of growth. When drifts form across the traveled way, immediate control is desired, and such control does not permit of waiting for trees to grow. Hence the snow fences—expensive, but quickly effective.

Again, however, down and cross drafts are caused mainly by the earth's contours and as long as the surrounding topography remains the same, drifts at certain points are inevitable.

ECONOMICAL PLAN

Snowdrifts, while they may be expected to recur at the same locations year after year, are inconstant objects, varying in depth with the season, and can not be treated as were the drifting sand dunes of the Colorado Desert, by building roads on top of them. Roads must be maintained through them, with an ever-continuing annual expense to keep them open to traffic. Therefore, a wait of a decade for tree growth which will control snow drifting, with a cost considerably less both for establishment and maintenance than that now required, is considered a wise and economically advisable plan.

At the locations in District II where planted, on Route 3 north and south of Weed, several species of pine and two of cedar were used. The pines are Jeffrey, Coulter, Austrian, Scotch, and Stone. The cedars are Incense and *Chamaecyparis lawsoniana*, both being native to the region. The use of these species of pines is experimental, to learn which of those that are cold or drought resistant and rapid growers will do best where short, hard winters and long, dry summers are the year's usual weather offering.

Scooter Pot Is Something New



G. E. Hudson and E. N. Tenocher operating Scooter Pots.

A device, which he calls a "Scooter Pot," to expedite the pouring of cracks and expansion joints in highway pavement has been designed by Ernest Wasson, highway maintenance foreman at Los Alamos, in District IX.

Mr. Wasson uses a wheel from a vacuum cleaner, a skate or a child's scooter, which he attaches to a standard pouring pot by means of a piece of strapiron running from the handle down the side of the pot and extended slightly to the front and one side. The wheel is offset about 1½ inches so as to run free of the pavement. The wheel supports the entire weight of the pot and contents, relieving the operator of back strain, allowing him to pour from an upright position and making pouring more accurate.

According to Mr. Wasson, pouring is speeded up at least 30 per cent by the use of his device.

Realtor—Now here's a beautiful home overlooking the lake.

Buyer—Where's the lake?

Realtor—That's what we're overlooking.

Pavement Slab Warp and How It Can be Prevented

(Continued from page 9)

Placing a bituminous seal on the expansive soils sufficiently impervious to prevent passage of moisture from above to the subgrade, and constructing thereon a blanket course of non-expansive material sufficiently thick to avoid perforation by form stakes, etc., of the bituminous membrane placed on the original soil, and also of sufficient thickness to distribute the load of traffic over a greater area where decreased bearing power of subfoundation due to natural moisture content is to be expected. (See Figures 2-4.)

California has not up to the present time undertaken to insure that the moisture content of expansive soils be brought to such condition at the time of construction that there will be no tendency for the subgrade to take up further moisture. Our reasons for avoiding this type of construction are that the traffic borne by California roads, especially the truck traffic, is extremely heavy, and we feel it essential that the bearing power of the subgrade in contact with the concrete pavement should be maintained as high as possible.

D. Restoration of Warped Pavements

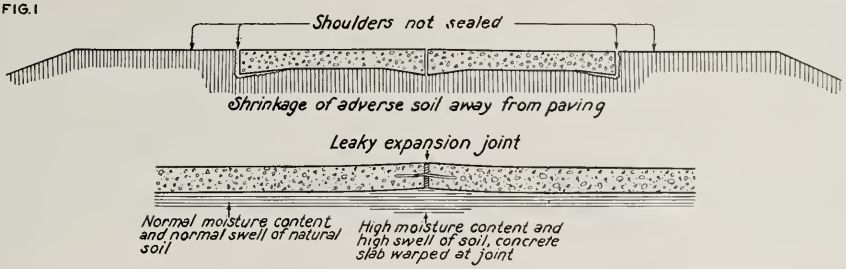
While the mud jack has been used with a certain amount of success for the restoration of warped pavements to original true grade, the method is expensive and experience in Minnesota, Kansas, Texas, and California indicates that increasing the moisture content of the subgrade to a uniform amount or to the proper amount for the location will remove the causes of unequal expansion of subgrade. To maintain such a satisfactory condition, it is necessary to insure tight joints in the pavement where membrane seal is not used, and it is thought that by use of the asphalt-latex joint seal recently perfected by the Materials and Research Laboratory that this may be accomplished. (See Figure 3.)

Observations in California, Texas,

(Continued on page 27)

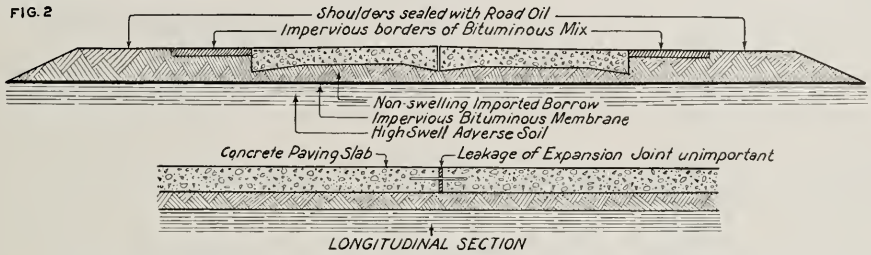
Action of Adverse Soil on Concrete Pavement

FIG. 1



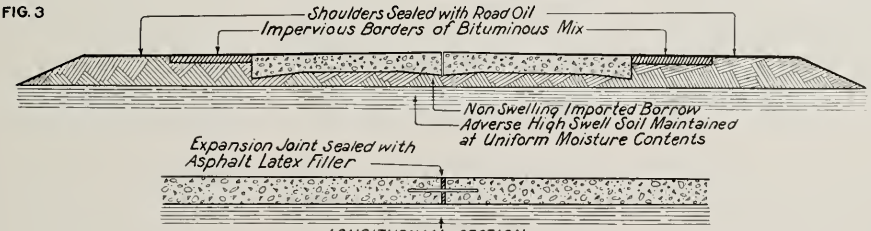
ACTION OF ADVERSE SOIL ON CONCRETE PAVEMENT WHERE NO SUB-GRADE TREATMENT IS USED

FIG. 2



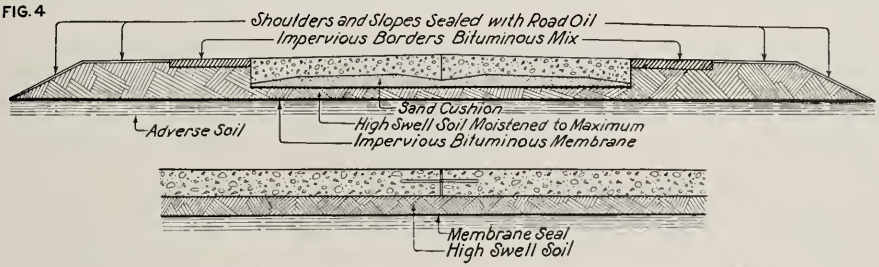
ACTION OF ADVERSE SOIL ON CONCRETE PAVEMENT WHERE ADEQUATE PROTECTIVE MEASURES ARE USED ~ BITUMINOUS MEMBRANE METHOD

FIG. 3



ACTION OF ADVERSE SOIL ON CONCRETE PAVEMENT WHERE ADEQUATE PROTECTIVE MEASURES ARE USED ~ SEALED JOINT METHOD

FIG. 4



PROTECTIVE MEASURES OVER ADVERSE SOIL WHERE IMPORTED BORROW NOT AVAILABLE



Typical section of new highway between Fresno and Herndon.

Highway Accomplishments in 1937

(Continued from page 20)

Southern California motorists are now in progress in San Bernardino County, the one providing for the widening of the pavement on twenty-one miles of the Foothill Boulevard between the Los Angeles County line and San Bernardino and a similar improvement to the Los Angeles-El Centro Route on 19.3 miles between the Los Angeles County line and Colton. These two widening projects are estimated to cost about $740,000.

In the construction of divided roadways the Division of Highways placed under contract this last fall an important project south of Bakersfield on the Los Angeles-Sacramento arterial.

This construction provides for two lanes of pavement between Grapevine Station and ten miles south of Bakersfield to be placed parallel to and west of the existing highway. The two roads will be separated by a twenty-foot landscaped parking and upon completion all south-bound traffic will use the new pavement and north bound traffic will travel on the present highway. The improvement is 19.1 miles in length and about $500,000 will be expended on its construction.

On the highway over the Santa Cruz Mountains between Los Gatos and Santa Cruz an improvement similar to the modern highway built two years ago between Inspiration Point and Scott Valley on the western slopes of the mountains is now under way on the easterly side between Los Gatos and Inspiration Point.

The engineer's estimate for the grading portion of this project included the largest quantity of roadway excavation ever included in a State highway contract—2,183,000 cubic yards. Drainage structures to be constructed under this contract will require 12,500 cubic yards of structure excavation; 2,600 cubic yards of Portland cement concrete; 310,000 pounds of bar reinforcing steel; and a total of 26,500 lineal feet of various size of corrugated metal pipe for culverts and underdrains. The surface will be bituminous treated rock constructed 46 feet wide by the road-mix method. The cost of this contract will be slightly over $1,000,000.

Two needed improvements were placed underway on sections of the Redwood Highway. One, between Sapp Creek and Pepperwood School in Mendocino County, providing 3.1 miles of new surfacing has been completed and on the other, in Humboldt County, the highway is being reconstructed and surfaced for three miles between Stegemeyer Bluffs and Myers. These two contracts will total $431,000.

On the Ukiah-Tahoe lateral the highway between Tarke and one mile south of Sutter City is being constructed on an entirely new alignment with a new concrete bridge across the Sutter By-Pass. Cost of this work, including the 5.5 miles of highway and the 4,143-foot trestle, will amount to $383,500.

One of the largest bridge contracts to be awarded during 1937 was for the new plate girder bridge across the Sacramento River at Red Bluff. This structure, consisting of two 143-foot, one 126-foot, two 108-foot and two 96-foot spans on concrete piers and abutments with steel pile foundations, will cost approximately $270,000.

Two contracts were let for new pavement on the West Side Pacific Highway, one for 5.8 miles between Delevan and Logandale in Colusa and Glenn counties and the other on 7.0 miles between Willows and Orland in Glenn County. This new pavement will cost nearly $426,000.

Nearly $833,000 is being expended for the construction of four much needed grade separations in addition to those mentioned in connection with other work. One is being placed under the tracks of the Union Pacific on Rosemead Boulevard, near Pico in Los Angeles County; one under The Atchison, Topeka and Santa Fe Railway on Wilson Way in Stockton; a third under the Southern Pacific at Redding; and the fourth under the same railroad at Livingston in Merced County.

Other important work has included continuation of the construction program on the Rosemead Boulevard-Cerritos Avenue thoroughfare between Pasadena and Long Beach; further widening of the coastal highway in Los Angeles north of Santa Monica; improvement of the Santa Paula lateral in Ventura County; and realignment of the Valley Route from Jahant Corner to one mile north of Galt in San Joaquin and Sacramento counties.

Highway Bids and Awards for January, 1938

ALAMEDA COUNTY—Between Mountain House and Contra Costa County line, about 4.1 miles to be graded and surfaced with plant-mixed surfacing on crusher run base. District IV, Feeder Road. Bodenhamer Construction Co., Piedmont, $55,957; J. A. Casson, Hayward, $61,778; Pacific States Construction Co., San Francisco, $59,343; Claude C. Wood, Stockton, $62,117; Piazza and Huntley, San Jose, $59,888; Fredericksen & Westbrook, Lower Lake, $62,127; A. J. Raisch, Los Gatos, $66,691; Jones and King, Hayward, $61,174; E. A. Forde, San Anselmo, $59,563; Granfield, Farrar and Carlin, San Francisco, $59,133; Oilfields Trucking Company, Bakersfield, $58,911; Union Paving Co., San Francisco, $63,683; Lee J. Immel, Berkeley, $68,489; A. Soda and Son, Oakland, $67,255. Contract awarded to George French, Jr., Stockton, $53,245.

DEL NORTE COUNTY—Between Wilson Creek and Last Chance slide, about 20 miles to be graded and seal coat applied and reinforced concrete slab bridge to be constructed. District I, Route 1, Section B. Poulos and McEwen, Sacramento, $142,297; N. M. Ball Sons, Berkeley, $167,772; Fredericksen & Westbrook, Lower Lake, $164,335; United Concrete Pipe Corp., Los Angeles, $163,772; Williams & Douglas, Kalispell, Montana, $146,912; Mercer Fraser Co., Eureka, $160,653; McNutt Bros., Eugene, Oregon, $167,721. Contract awarded to Hemstreet & Bell, Marysville, $132,154.00.

FRESNO COUNTY—About 3 miles south of Sanger, a steel girder bridge consisting of five 74-foot spans and two 65-foot spans and approaches to be constructed. District VI, Feeder Road. A. Soda and Son, Oakland, $60,539; Bodenhamer Construction Co. and W. E. Van Bokkelen Construction Co., Oakland, $72,452. Contract awarded to Earl W. Heple, San Jose, $57,845.

LOS ANGELES COUNTY—An undergrade crossing to be constructed, consisting of steel girder track span on concrete abutments and approximately 0.49 mile of roadway to be graded and paved with Portland cement concrete and shoulders and service road to be surfaced with plant-mixed surfacing. District VII, Route 168, Section B. Byerts and Dunn, Los Angeles, $140,733; Griffith Company, Los Angeles, $137,111; Carlo Bongiovanni, Los Angeles, $139,990; Oswald Bros., Los Angeles, $124,706; John Strona, Pomona, $136,388; Oscar Oberg, Los Angeles, $131,934; Metropolitan Construction Co., Los Angeles, $139,220; Gibbon & Reed Co. Burbank, $146,710; Claude Fisher Co., Ltd., Los Angeles, $130,841; J. F. Knapp, Oakland, $143,240; Vido Kovacevich, South Gate, $124,313; Dimmitt & Taylor, Los Angeles, $128,674; United Concrete Pipe Corp., Los Angeles, $132,630; J. E. Haddock, Ltd., Pasadena, $134,469; Fred E. Potts Co., Los Angeles, $145,026; V. R. Dennis Construction Co., San Diego, $138,731. Contract awarded to C. O. Sparks and Mundo Engineering Co., Los Angeles, $122,652.20.

LOS ANGELES COUNTY—In North Hollywood at the Division of Highways Shop Yards, shop building to be painted. District VII. John H. Axton, Lynwood $1,202; J. P. Carroll Co., Inc., Los Angeles. $1,275; Hoelzel Ehmig Co., Los Angeles, $1,305; H. J. McKinley, Beverly Hills, $1,390; David Wein, Los Angeles, $1,680; Wm. Gelfan, Los Angeles, $1,820; D. Zelinsky & Sons, Inc., Los Angeles, $1,826; Klaas Brothers, Los Angeles, $1,940. Contract awarded to Stanley F. McGrath, West Los Angeles, $976.00.

LOS ANGELES COUNTY—Bridges across Corral Creek, Salstice Creek, and Escondido Creek at points about 16 miles north of Santa Monica to be widened. District VII, Route 60, Section A. Oscar Oberg, Los Angeles, $54,582; John Strona, Pomona, $49,970; Byerts & Dunn, Los Angeles, $58,486; J. E. Haddock, Ltd., Pasadena, $51,382. Contract awarded to J. S. Metzger & Son, Los Angeles, $46,779.50.

LOS ANGELES COUNTY—An undergrade crossing under the tracks of the Southern Pacific Railroad near Rudell Station and approaches to be constructed. District VII, Route 168, Section C. Oscar Oberg, Los Angeles, $111,540; Metropolitan Construction Co., Los Angeles, $131,710; Geo. J. Bock Co., Los Angeles, $119,915; Claude Fisher, Ltd., Los Angeles, $121,553; John Strona, Pomona, $113,112; Fred E. Potts Co., Los Angeles, $120,454; Dimmitt & Taylor, Los Angeles, $113,336; C. O. Sparks and Mundo Engineering Co., Los Angeles, $120,837; Griffith Co., Los Angeles, $118,313; Vido Kovacevich, South Gate, $110,922; J. E. Haddock Co., Ltd., Pasadena, $112,308. Contract awarded to United Concrete Pipe Corp., Los Angeles, $109,853.50.

MERCED COUNTY—Seven timber bridges on timber pile bents and a corrugated metal pipe culvert at points about ten miles to sixteen miles southeast of Merced. District X, Feeder Road. Earl W. Heple, San Jose, $28,346; Rexroth & Rexroth, Bakersfield, $28,449; Palo Alto Road Materials Co., Ltd., Palo Alto, $28,708; C. B. Cameron & Son, Merced, $28,848; F. Kaus, Stockton, $29,504; J. S. Metzger & Son, Los Angeles, $29,941; A. Soda and Son, Oakland, $32,607; N. M. Ball Sons, Berkeley, $32,975; B. A. Howkins & Co., San Francisco, $33,565; M. A. Jenkins, Sacramento, $27,836; John Rocca, San Rafael, $35,272; Bundesen & Lauritzen and Delta Dredging Co., Pittsburg, $35,946. Contract awarded to E. G. Perham, Los Angeles, $25,628.20.

ORANGE COUNTY—At Oso Creek, about 0.9 mile to be graded and surfaced with plant-mixed surfacing and a reinforced concrete bridge to be constructed. District VII, Route 2, Section A. Griffith Company, Los Angeles, $47,659; J. E. Haddock Co., Ltd., Pasadena, $46,141; C. R. Butterfield-Kennedy Co., San Pedro, $53,483; Sully Miller Contracting Co., Long Beach, $44,077; N. Perscallo, Los Angeles, $63,096; Claude Fisher Co., Ltd., Los Angeles, $53,578; V. R. Dennis Construction Co., San Diego, $43,651; Mojave Corp., Los Nietos, $42,807. Contract awarded to C. O. Sparks and Mundo Engineering Co., Los Angeles, $42,581.50.

SAN DIEGO COUNTY—A reinforced concrete slab bridge across Sweetwater River between National City and Chula Vista on Highland Avenue, consisting of eighteen 22-foot spans and two 7-foot 6-inch spans on cast in place concrete pile bents. District XI, Feeder Road. Contracting Engineers Co., Los Angeles, $45,696; Griffith Co., Los Angeles, $46,536; Gibbons and Reed Co., Burbank, $47,232; Byerts & Dunn, Los Angeles, $46,861; S. A. Cummings, San Diego, $44,242; Werner & Webb, Los Angeles, $50,755; John Strona, Pomona, $50,326; B. O. Larson, San Diego, $43,826; V. R. Dennis Construction Co., San Diego, $39,729; B. G. Carrol, San Diego, $42,255. Contract awarded to M. H. Golden, San Diego, $38,553.11.

SAN JOAQUIN COUNTY—Between Bacon Island Ferry and Mandeville Island Ferry, about 5.5 miles to be graded and surfaced with untreated crushed gravel or stone. District X, Feeder Road. Claude C. Wood, Stockton, $29,880; Louis Biasotti & Son, Stockton $30,036; E. A. Forde, San Anselmo, $31,591; George French, Jr., Stockton, $31,443; A. G. Raisch, San Francisco, $31,494; Clausen and Corfield, Berkeley, $32,591; Piazza & Huntley, San Jose, $33,095; Beerman & Jones, Stockton, $33,350; Bodenhamer Construction Co., Oakland, $33,764; A. Soda & Son, Oakland, $34,537; Lee J. Immel, Berkeley, $34,850; J. R. Reeves, Sacramento, $39,219. Contract awarded to Fredericksen & Westbrook, Lower Lake, $28,789.50.

SANTA CLARA COUNTY—Between north line of Las Uvas Rancho and Croy Road, about 3.9 miles to be graded, surfaced with gravel base, and armor coat applied. District IV, Feeder Road. Granfield, Farrar & Carlin, San Francisco, $73,244; Fredericksen & Westbrook, Lower Lake, $78,987; Piombo Bros. & Co., San Francisco, $79,305; Poulos & McEwen, Sacramento, $81,409; A. Teichert & Son, Inc., Sacramento, $87,273; Pacific Truck Service, Inc., & L. C. Karstedt, San Jose, $89,460; Chas. L. Harney, San Francisco, $95,476; Guy F. Atkinson Co., San Francisco, $104,879; Young & Son Co., Ltd., Berkeley, $83,152; Hanrahan Company, San Francisco, $81,663; J. L. Conner and Sons, Monterey, $74,865; Crow Bros. Construction Co., Los Angeles, $78,774. Contract awarded to Bodenhamer Construction Co., Oakland, $71,873.77.

SANTA CRUZ COUNTY—A reinforced concrete girder bridge across Salsipuedes Creek, about ½ mile northeast of Watsonville, consisting of one 40-foot span and two 30-foot spans, and about 0.23 mile of roadway to be graded and surfaced with crusher run base topped with armor coat. District IV, Route 67, Section A. A. Soda and Son, Oakland, $27,751; B. A. Howkins & Co., San Francisco, $26,819; John Carcano, San Rafael, $26,957; Clausen & Corfield, Berkeley, $27,793; Valley Construction Co., San Jose, $28,531; Granite Construction Co., Ltd., Watsonville, $28,749. Contract awarded to Earl W. Heple, San Jose, $24,851.90.

VENTURA COUNTY—Construction of a truck shelter at the El Rio Maintenance Station between Ventura and Oxnard. District VII, Route 2, Section C. Alfred A. Jacobson, Pasadena, $5,888; Contracting Engineers Co., Los Angeles, $6,285; George Macleod, Ventura, $6,458; Hansen & Izer, Ventura, $6,594; Victor L. and Wm. B. Jacobson, Los Angeles, $9,380. Contract awarded to Standard Construction Co., Los Angeles, $5,652.

Q. & A. DEPARTMENT

Q. We want you to settle an argument. When does a pedestrian have the right of way?

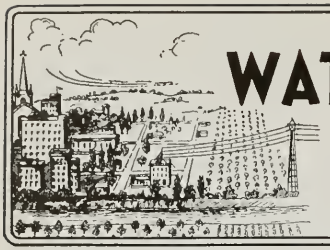
—Constant Reader.

A. When he's being rushed to the emergency hospital in an ambulance.

"Did anybody drop a roll of bills with a rubber band around them?" asked an old gentleman in the train.

"Yes, I did," said several voices.

"Well, I just picked up the rubber band," said the old gentleman calmly.



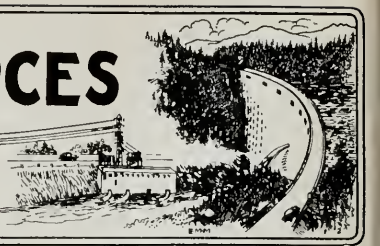
DIVISION OF WATER RESOURCES

OFFICIAL REPORT

FOR THE MONTH OF

January, 1938

EDWARD HYATT, State Engineer



THE Bureau of Reclamation announced during the month that the Southern Pacific railroad through the Shasta Dam site would be relocated so that work can progress on dam construction. The relocation will involve about a half mile of new line, more than half of which will be a tunnel under the right abutment of the dam site. Bids for the construction of this tunnel will be opened near the end of Femruary. The Bureau also announced that bids will be received soon for sixteen pumps for the Contra Costa Canal and for materials for the lining of eight miles of this canal. Work has continued and good progress is being made on the construction of the Contra Costa Canal and the government camp for Shasta Dam. Surveys and the preparation of plans for the Shasta Dam and the relocation of the Southern Pacific Railroad for Shasta reservoir have continued and considerable progress was made on surveys for the San Joaquin pumping system and canals for the project.

IRRIGATION DISTRICTS

New construction, repairs and replacement of structures are being carried out in many of the districts during the winter months while plants are shut down, and district forces are available for the work. A number of cooperative projects are also being undertaken with WPA or other Federal assistance, thus providing needed employment and at the same time accomplishing necessary betterments to the district systems at minimum cost.

Woodbridge Irrigation District has signed an agreement with the East Bay Municipal Utility District by which the prior rights of the irrigation district to flow of the Mokelumne River are recognized and fixed in amounts ranging from 30,000 to 45,000 acre-feet per year. A suit brought to determine the relative water rights has been dismissed.

The construction of the Lake Gregory Dam in San Bernardino County, owned by the Crest Forest County Water District, is approaching completion with the exception of the riprapping on the upstream face of the structure and the concreting of the spillway lining. The completion of this part of the work will probably be dependent on weather conditions.

WATER RIGHTS

Supervision of Appropriation of Water.

Twenty-five applications to appropriate were received during December, 25 were approved, and 7 were denied. The rights were confirmed under 10 permits and 17 permits were revoked.

Inspection reports are in the course of preparation covering projects which were investigated during the past field season, and during November 223 reports were received from permittees and licensees, which reports are under study for the purpose of determining appropriate action.

SUPERVISION OF DAMS

Application for the approval of plans and specifications for construction of the Laguna Dam of The Irvine Company, Tustin, California, was filed on January 5, 1938. This dam is to be an earth fill structure 34 feet in height with a storage capacity of 300 acre-feet, situated on an unnamed creek tributary to San Diego Creek which flows into Newport Bay in Orange County. The estimated cost is $23,000.

Application for approval of plans for the alteration of the Kunkle Dam of the Pacific Gas and Electric Company, situated on Kunkle Creek tributary to West Branch of North Fork of Feather River in Butte County, was received on December 22, 1937. This application was approved by the State Engineer on January 3, 1938.

SACRAMENTO-SAN JOAQUIN WATER SUPERVISION

During the past month activities have been wholly in the office assembling the field data gathered during the summer months in order to compile a mimeographed report showing the diversions, acreage irrigated, stream and return flows in the Sacramento and San Joaquin valleys.

CALIFORNIA COOPERATIVE SNOW SURVEYS

With several feet of snow in the mountains as a result of the storm period January 15th to 20th, Rangers of the Plumas National Forest were instructed in the details of making snow measurements at the new snow courses established this year in that area.

In the office, work has continued on compilation of precipitation and runoff data and the working up of the natural flows that occurred during the past season. The actual historical figures compare well with those estimated in last April's snow survey bulletin.

CONN VALLEY PROJECT

Work was initiated during the month on investigations of the Conn Valley reservoir and dam sites in Napa County to determine the availability of the reservoir as a possible source of additional water supply for State institutions in Napa Valley. Investigations are being made of reservoir capacity, water supply, geology of the dam sites and possible cost of the project.

FLOOD CONTROL AND RECLAMATION

Relief Labor Work.

At the present time approximately 70 relief laborers are employed, cleaning out debris in Butte Slough, cleaning drains of the Pump No. 3 system, and removing debris from the Feather River near Nicolaus.

Sacramento Flood Control Project.

Work has been resumed on the construction of five timber bridges in the Dry Creek project near Wheatland.

The Reclamation Board has requested this office to remove certain levees in the Feather River overflow channel, which have been replaced by new set-back levees. This work is considered an emergency for immediate construction, and $20,000 has been allocated. Actual construction is under way with five heavy bulldozers.

Emergency Levee Repairs.

On January 14th Governor Frank F. Merriam made available the sum of $150,000 by Executive Order No. E 177, for use in making emergency repairs to levees in the Sacramento Valley outside of the Sacramento Flood Control Project. The work is being done under the general administrative direction of Colonel A. M. Barton, Chief Engineer and General Manager of the Reclamation Board, cooperating with the State Engineer. R. L. Jones, Deputy State Engineer, is in direct charge of construction.

State Highway Engineers View Eastern Roads

(Continued from page 5)

due to the abundant roadside vegetation growing right up to the pavement edge.

The absence of improved shoulders throughout the middle west and eastern States is very noticeable and gives the impression, which as a matter of fact it does, of narrowing up the effective driving width of the pavement.

On the entire trip the group reports they did not see anything that would approach the asphaltic construction of the West or any concrete roads which were built to better standards than those now being laid in California.

However, it would seem that the people of California can take a leaf from the book of experience of New York, New Jersey, and Massachusetts and give more consideration to the congested areas of the State, solving the problems by the construction of through boulevards with service roads on each side or agreements preventing abutting property from any contact with such speedways except at stipulated intersectional points where the clover leaf type of construction and accelerating entrance lanes would be placed.

In Memoriam

Comte Edward O'Connell

Death, striking suddenly and unexpectedly, summoned Comte Edward O'Connell, Chief Clerk of the headquarters staff of District VIII, Division of Highways, San Bernardino, on January 24.

Prominent in civic affairs in San Bernardino, president of the California State Employees' Association, past vice commander of the United Veterans of the Republic and a leader in the American Legion, Mr. O'Connell was widely known throughout the State. His active career ended in his forty-first year. Death was due to a heart attack.

The following tribute to Mr. O'Connell comes from Mr. E. Q. Sullivan, District Highway Engineer in San Bernardino:

"The untimely death of Mr. O'Connell has been a severe shock to myself and the entire State Division of Highways. His passing is mourned by everyone. He was of a buoyant, cheerful disposition. It is difficult to realize that he is no longer with us because of his apparent good health.

"Mr. O'Connell was head of the District VIII accounting department. The keeping of the accounts for the division of highways is a complex and difficult work. Mr. O'Connell handled his work in a manner to warrant complete confidence in his competence and integrity. He was truly a trusted assistant in the administration of District VIII accounting department throughout all the years.

Mr. O'Connell is survived by his widow, Floy; a son, Comte Jr., 13; two stepchildren, Dorothy Irwin and George Irwin, all of San Bernardino; his mother, Mrs. George O'Connell and three brothers.

Livingston Subway Will Abolish Crossing

(Continued from page 16)

New right of way was acquired for the entire length of the construction. The area traversed, for the most part, consisted of vineyard and orchard land. The right of way for this construction will cost approximately $22,500.

The construction based on the contractor's bid plus estimated supplemental work, contingencies and engineering will cost approximately $264,500.

The principal items of construction quantities and unit bid prices are:

Item	Quantities	Unit price
Roadway excav.	57,000 c. y.	$0.30
Overhaul	750,000 st. yd.	0.005
Cl. "B" P. C. C. (pvmt)	5,380 c. y.	8.00
Cl. "B" P. C. C. (thick pvmt)	1,525 c.y.	7.00
Cl. "A" P. C. C. (str.)	1,210 c. y.	14.25
Cl. "A" P. C. C. (curbs, gut.)	1,115 c. y.	11.00
Bar reinf. steel	225,000 lbs.	0.053
Str. steel	216,000 lbs.	0.09
Douglas fir piles	10,400 ft.	0.25

Louis Biasotti & Son, of Stockton, California, are the contractors. W. J. Deady is Resident Engineer in charge for the State. Inspection is being handled jointly by the Bridge Department and District X.

Pavement Slab Warp in California and Prevention Methods

(Continued from page 22)

and other States indicate that the moisture content in subgrades not originally moisture treated gradually approaches the same moisture content as that in the subgrades which were originally moisture treated. We are not, however, prepared to say that under California conditions where rainfall may not occur for several months a subgrade which was moisture treated would not vary in moisture content throughout the year. In fact, from our experience on the pavement near Williams which originally gave us trouble, we believe that the moisture content does vary from time to time. It appears that the experience in Missouri and Kansas confirms these conclusions.

(To be continued)

EXPLANATORY NOTES:

Adobe is the California designation of black clayey top soil showing high shrinkage or swell with moisture changes.
Shrinkage as used herein refers to lineal shrinkage in per cent of the specimen prepared under standard methods.
Swell as used herein refers to lineal swell in per cent of the specimen prepared under standard methods.
Bearing power is reduced to pounds per square inch for 0.2 inch penetration of testing disc.
Bearing power "wet" refers to a specimen which after standard preparation has been immersed in water for four days.
Bearing power "dry" refers to a specimen which has been properly moistened and compacted at 2,000 lbs. per square inch.
Roughness index is the roughness in inches per mile of paving as taken with "roughometer" attached to an automobile.
Thickness of imported borrow refers to compacted thickness.
Membrane is reported in gallons per square yard.
Warp is reported as the variation in decimal fractions of an inch of high joints above the true plane of the pavement.

New Highway Through Town of Mojave Eliminates Bottleneck

(Continued from page 18)

county road from Lancaster to Mojave, that a high type road to this locality was available. A fifteen foot concrete pavement was constructed in 1922 from the Los Angeles-Kern County line, south of Mojave, to the northerly city limits of Mojave. This was widened in 1935 by the addition of two eight-foot shoulders to afford a twenty-foot road width, and a portion of the street area was oiled to alleviate the dust nuisance.

HIGHWAY WORK BEGUN

To accommodate the increase in traffic within the town, the new construction, started on September 10, 1937, representing an expenditure of approximately $28,000, affords a 57.5 foot width of plant-mixed surfacing bordered by 1.5 foot concrete gutters and 0.5 foot concrete curbs on both sides of the main street within the city limits. The previously constructed concrete pavement served as a partial base for the central twenty-two foot portion of the new surfacing.

In order that the bearing value of the additional base required would be commensurate with that of the existing concrete pavement, a trench seven feet in width and one foot in depth was constructed adjoining the concrete pavement and filled by thoroughly compacting therein the salvaged oiled shoulders. This was done by blading the existing oiled shoulders onto the concrete, remixing it to remove excess moisture and compacting it in the trench in very light layers so that maximum compaction would be obtained.

CONSTRUCTION PROBLEMS

The use of a flexible material in conjunction with rigid concrete to form the base of the wearing course introduced many problems as to the ultimate behavior of the pavement. The original subsoil was a clay with its attendant high capillarity. Under the concrete, no serious settlement was observed; hence, it was assumed that the subsoil was stable and that a foot of well-compacted asphaltic treated aggregate would be sufficient to provide rigidity if the subsoil remained in a state equal to that under the concrete.

The area adjoining the central twenty-two feet is dedicated to parking area and receives much lighter impact than the central portion. Throughout this area, the subsoil was removed to the depth of a foot below subgrade and backfilled with imported borrow of high stability, the whole slush-rolled to obtain maximum compaction.

TRAFFIC UNIMPEDED

Before placing the three inches of plant-mixed surfacing between the gutter lines, the concrete pavement and the seven feet of compacted shoulder material were given an application of one-tenth of a gallon per square yard of asphaltic emulsion. The remaining areas between the gutter lines were given a prime coat of approximately one-quarter of a gallon per square yard of liquid asphalt SC-2.

Curbs and gutters were of integral construction and at street intersections were constructed at entrances to garages, service stations and driveways to allow access for traffic.

By prior arrangement with the business men of Mojave, all through traffic was routed over adjoining streets and the entire project completed with but little inconvenience to the traveling public. The cooperation shown in allowing the main business street to be closed during construction was wholehearted and was reflected in returning to use at an early date the completed street at a lowered cost to the State.

Early pictures of Mojave were made available by the courtesy of John Nestor, postmaster of Mojave.

A struggling young author had called on a publisher to inquire about a manuscript he had submitted.

"This is quite well written," admitted the publisher, "but my firm publishes only work by writers with well-known names."

"Splendid," cried the writer. "My name's Smith."

Traffic on Bay Bridge Declines During January

ALTHOUGH traffic over the San Francisco-Oakland Bay Bridge showed a decline in the month of January as compared to December, it nevertheless exceeded its seasonal quota, according to Earl Lee Kelly, Director of Public Works.

A total of 672,433 vehicles crossed the span during January as against 723,281 for December. This is a decrease of approximately 50,000 vehicles from the preceding month, but an increase by the same amount over the estimated quota for January.

VEHICLES TOTAL ELEVEN MILLION

Total number of vehicles to cross the span since is was opened fourteen and one-half months ago was 11,117,042. There was a daily average of 21,691 vehicles crossing the bridge during January, bringing in total revenues of $353,859.95

Best day of the month was New Year's Day, January 1, when 31,172 vehicles crossed the structure. Lowest day was January 3, a stormy day, with 18,831 vehicles.

January of last year, when a 65-cent toll was in effect, showed a decrease in traffic but an increase in revenue over figures for the same period in 1937. In January of 1937 there were 575,083 vehicles crossing the bridge, bringing in revenues of $384,092.27.

A general decrease in all classifications of traffic was revealed in a comparison of January, 1938, figures with those of the preceding month.

COMPARATIVE FIGURES

Comparative figures follow:

	Total Dec.	Total Jan.	Total Since Opening
Passenger Autos	681,506	633,115	10,562,142
Auto Trailers	856	649	18,165
Motorcycles	2,077	2,117	38,434
Tri-Cars	977	798	9,900
Trucks	26,236	24,239	351,344
Truck Trailers	954	883	23,340
Buses	10,675	10,632	113,717
Total Vehicles	723,281	672,433	11,117,042
Extra Passengers	189,480	170,440	2,396,518
Freight, Lbs.	59,671,837	55,840,498	804,036,518

Visitor: "And what's your name, my good man?"

Prisoner: "9742."

Visitor: "Is that your real name?"

Prisoner: "Naw, dat's just me pen name."

STATE OF CALIFORNIA

Department of Public Works

Headquarters: Public Works Building, Twelfth and N Streets, Sacramento

FRANK F. MERRIAM.....Governor

HARRY A. HOPKINS.....Assistant Director

EARL LEE KELLY.....Director

EDWARD J. NERON.....Deputy Director

CALIFORNIA HIGHWAY COMMISSION

H. R. JUDAH, Chairman, Santa Cruz
PHILIP A. STANTON, Anaheim
PAUL G. JASPER, Fortuna
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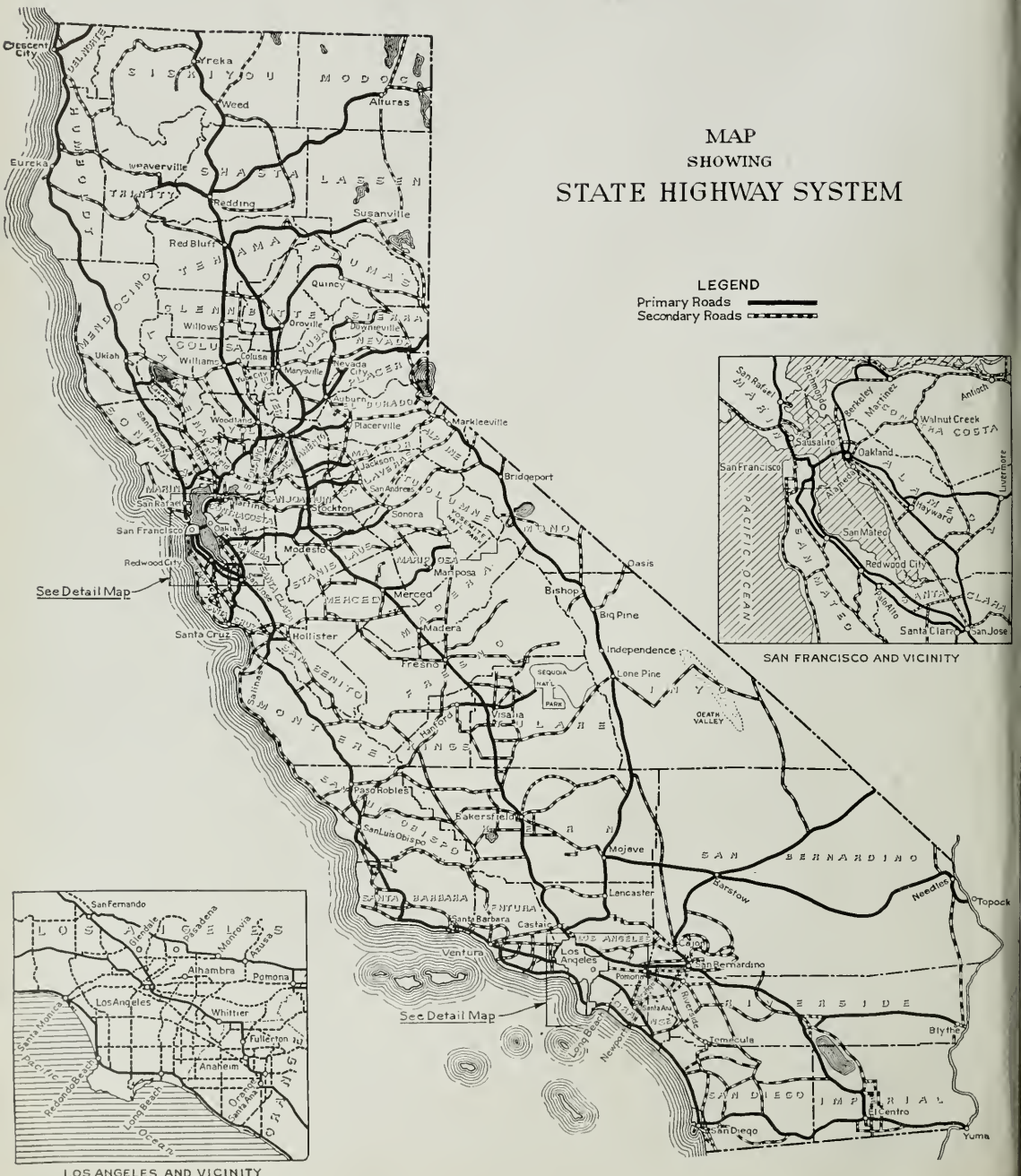
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Official Journal of the Department of Public Works

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CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways of the Department of Public Works, State of California

EARL LEE KELLY, Director C. H. PURCELL, State Highway Engineer JOHN W. HOWE, Editor K. C. ADAMS, Associate Editor

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Vol. 16 MARCH, 1938 No. 3

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Safety Engineer Appointed To Head New Department in State Division of Highways

THE Division of Highways has added a Department of Safety to the headquarters' staff. Engineering investigation of the rising accident toll, together with public interest energized with anxiety and concern, has pointed to the need of a separate bureau or department to more closely observe and study the development of traffic problems.

Recognizing this need, Director of Public Works Earl Lee Kelly and State Highway Engineer C. H. Purcell began a study of a budget and the scope of operation for such a department late in 1937, culminating in the announcement of the organization of the department early in February this year.

PRIME PURPOSE

Increasing traffic with consequent increasing accident frequency, and the experience gained through the years of literally lifting traffic out of mud and dust, has gradually developed the conviction that a highway department has as a prime purpose the providing of a system of highways which will obtain a safe and rapid movement of hundreds of thousands of motor vehicles of many types in a constant and more accelerated movement as time progresses.

The department will in no way supersede nor conflict with such safety activities as are already under way, but will strengthen and augment those activities, combining its efforts with others in an endeavor through analysis and study of traffic statistics to advance the movement toward a goal of safe highway driving.

VICKREY APPOINTED

Effective March 1, Mr. J. W. Vickrey was appointed as Safety Engineer in charge of the new department. With the exception of a few months in 1920, Mr. Vickrey has been with the Division of Highways since April, 1917, and for approximately the past six years he has been District Engineer of District I at Eureka. He has a thorough knowledge of all



J. W. VICKREY

phases of highway work and is particularly well fitted by experience to handle the new department. As Safety Engineer, Mr. Vickrey will report directly to State Highway Engineer C. H. Purcell.

In a statement announcing the addition of the new department and the appointment of Mr. Vickrey, Mr. Purcell said:

"While the Division of Highways has been keeping pace with safety developments through its several departments, and as a matter of fact has collected more data on the subject than any other agency, the new department within the Division will coordinate and direct along this particular line.

ENTAILS MUCH STUDY

"In spite of the continued improvement of our highways, accidents seem to vary directly with the volume of traffic. Furthermore, traffic accident records indicate that something must be done about the driver and the pedestrian. Just what we may do is something that must be continually studied as a specific function of a safety engineer.

"Highway designs must be watched to see that no possible safety features are overlooked. The relation of traffic problems to other economic and social problems must be kept in mind. There are no all inclusive methods of traffic safety. They are still in the process of development.

DEMANDS COOPERATION

"It will be Mr. Vickrey's duty to assist the various departments of design, construction, and maintenance in furnishing and obtaining all possible information necessary for their work in order to promote safety on California's highways. This will mean cooperation with the various national, state, and local agencies now interested or engaged in this phase of the work. The work being done by other state highway departments and other safety engineers will be considered.

"Likewise the benefit of the California Division of Highways' experience along safety lines may be coordinated and made readily available to the various agencies which are now vigorously working on the problem of safety, particularly in connection with the awakening and educating of the driver to his responsibility.

"The results of technical studies, the Division's aims, endeavors, and accomplishments in building safer highways and reducing accidents must also be presented to the public for their enlightenment and approval.

HUMAN ELEMENT INVOLVED

"The problem may appear to be more sociological than engineering; however, the fact that 37,000 people a year are killed on the streets and highways of the United States has forcibly brought to the attention of the Highway Department that no stone should be left unturned that

(Continued on page 17)

Flood Fighters Save Levees

By S. H. SEARANCKE
Associate Hydraulic Engineer, Division of Water Resources

NORMALLY, in the Sacramento Valley, December is not regarded as a month of storms and high water. However the December just past proved itself an exception to the rule.

From the ninth to the thirteenth of that month storm clouds rolled over the watersheds tributary to the Sacramento River and expended themselves in a downpour of unusual intensity. Heaviest among the rainfalls recorded for twenty-four-hour periods were 7.75 inches at Kennett; 7.25 inches at Mineral; 11.61 inches at Brush Creek (Feather River watershed); 11.48 inches at Scales (Yuba River watershed) and 8.43 inches at Spaulding.

Even at the higher altitudes precipitation was in the form of rain, and since there was no blanket of snow to absorb and retard it, the runoff was torrential and the streams affected quickly rose to flood stages. At Red Bluff, Knights Landing, and Marysville record high water marks were established.

TORRENTS ATTACK LEVEES

The straining waters searched out whatever weaknesses there were in the river levees and kept men busy day and night plugging holes made by rodents, building up low stretches and protecting banks against the eroding action of the current. Human effort, however, was not a match for the waters at every point of attack. Here and there trickles broke through, which under pressure increased in size until they became like mill races tearing material from the levees and inundating farm lands.

Many such breaks occurred on both sides of the Sacramento River above Colusa, the escaping waters quickly filling up the Colusa basin, flooding thousands of acres of farm land, cutting off means of communication, drowning stock, entering homes, and bringing inconvenience and misery to hundreds of residents.

The Feather River also broke through at several points. From Hamilton Bend near Biggs a raging torrent swept westerly across country towards Butte basin, tearing off top soil, cutting deep washes and gullies, uprooting fruit trees, carrying away farming facilities and leaving piles of drift and debris in its wake.

WEIRS ARE OPENED

In contrast to the damage and distress prevalent further up the valley, residents of Sacramento and vicinity enjoyed the utmost security and freedom from alarm. By far the greater part of the flood waters of the Sacramento and Feather rivers escaped through Fremont Weir about twenty miles above Sacramento and made their way harmlessly to the bay by way of the Yolo Bypass.

The situation was further relieved for Sacramento by the opening of the gates of Sacramento Weir, thus making provision for the excess of the waters of the American River. The flood crest which reached record stages at stations on the upper river produced only moderate gage heights at the city of Sacramento.

FARMERS HARD HIT

In due time the water in the river channels receded, the inundated lands drained, and normal farming operations again became possible. But it was obvious there could be no security so long as the levee breaks remained open to permit further inundation by each succeeding freshet.

The breaks must be closed, but that was an expensive undertaking and who was going to foot the bill?

The farmers most concerned were the least able to pay. Two of the breaks occurred in levees which are maintained by the Division of Water Resources and these were repaired as a matter of routine. Others had occurred in levees for which the California Debris Commission and the Reclamation Board jointly were responsible, and these were repaired. But there were still many breaks in localities where neither the War De-

(Continued on page 27)



Flood waters of Little Chico Creek rage through orchard on Cornell Ranch near Lone Pine Avenue in Butte County.



When the Sacramento River went on a rampage last December. Upper picture was taken on Phelan Ranch near Chico in Butte County and shows huge break in the Sacramento River levee and portion of hundreds of inundated acres. The lower photograph was taken at approximately the same spot after the levee closing operations had begun. The sacking job prevented overtopping of the newly built fill during later storms.

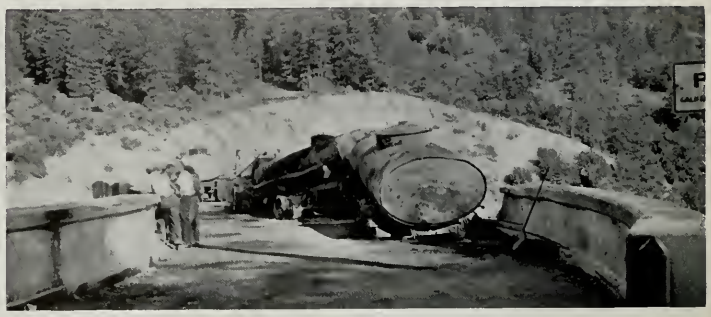
OLD BRIDGES ARE MENACE

By F. W. PANHORST, Bridge Engineer

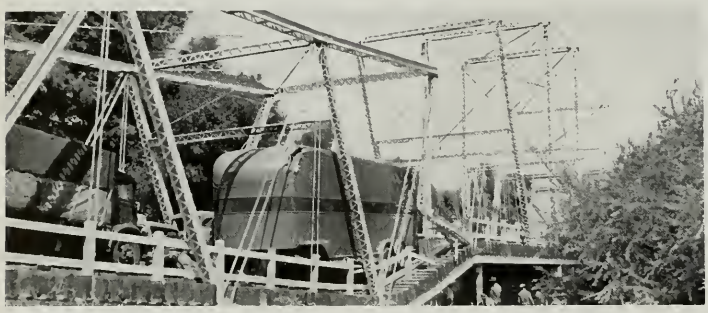
DURING the past few years there have been many cases where heavy vehicles have crashed into bridges on the State Highway System resulting in the complete collapse of the spans or otherwise causing their failure.

What would happen if a huge truck, weighing 60,000 lbs. going at the rate of 30 miles per hour, crashed into a supporting member of an elevated water tank?

The result can easily be imagined. Obviously the water tank is designed only to sustain a vertical load and the comparatively small horizontal force exerted by wind pressures. The same is true of a bridge. In other words, no matter how sturdily a bridge is constructed, regardless of the fact that it can carry safely the heavy loads which represent a vertical force placed upon the structure, it does not follow that the same bridge can withstand an equal or greater force in a horizontal direction.



At top, gasoline tank truck crashes Pit River Bridge near Dunsmuir and burns.



Center, overloaded truck causes collapse of San Joaquin River Bridge in Merced County.

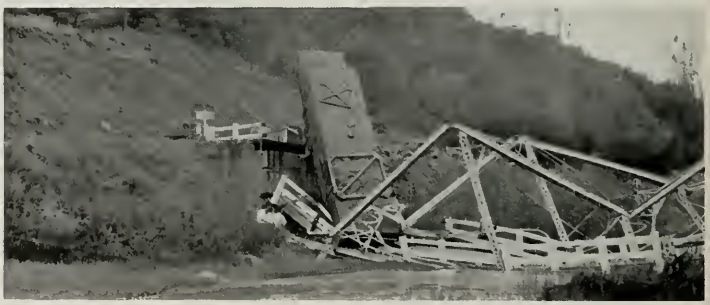
TRUCK DEMOLISHES BRIDGE

Many of the bridges on the State Highway System are of the through truss type, in which the supporting members extend above the deck of the structure. The more serious accidents have occurred in connection with through truss bridges of narrow roadway width.

Unless proper precautions are taken by vehicles when crossing such structures, one of the side members may be struck, causing the complete collapse of the span. The seriousness of such an occurrence can readily be seen for it may not only cause loss of life and property damage, but in all probability may block all traffic until the span can be reconstructed.

On October 20, 1937, a truss span over Woods Creek on the Oak Flat Road was demolished by a truck carrying two large pontoons to be used in the construction of a gold dredger. The truss was in good condition and strong enough to carry safely legal loads under normal circumstances. The evidence establishes the fact that an end post member of the truss was struck by an overhanging pontoon and knocked from its supports. The result was that the complete span fell into the creek with the truck on it as shown in the accompanying photograph.

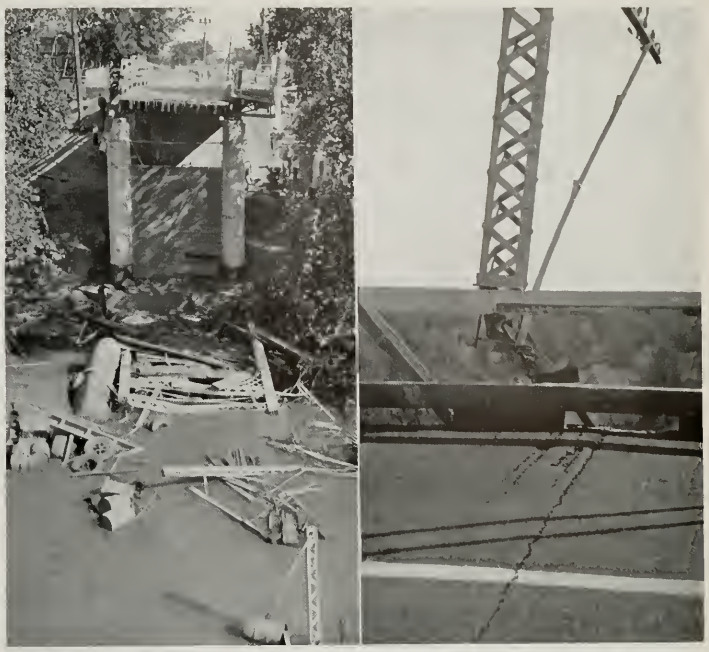
A short time before, on September 23, 1937, the westerly arm of the



Lower, truss span over Woods Creek on the Oak Flat Road demolished by truck.

swing span of the San Joaquin River Bridge on the Pacheco Pass Road collapsed under a combination of excess loads, excessive speed and the striking of some of its truss members. This bridge had been posted for reduced load and speed limit. The collapsed span with the trucks on it is shown in the accompanying photograph.

On December 2, 1937, a heavy load requiring extra high clearance tore out the portal framing and damaged the end post of a timber truss bridge over Yager Creek on the Trinity Road between Red Bluff and Fortuna. This span had been strengthened temporarily by placing supports under the center of each beam. It was only for this reason that the trusses did not collapse. It was possible in this case to place supplementary bents under the floor beams and maintain traffic over the bridge, subject, however, to the probability of these temporary supports being washed out during any flood that might occur during the winter.



Left—Sacramento River Bridge at Red Bluff collapses. Trucks and steel framework are shown in river. Right—Tower on San Benito River Bridge near Hollister damaged by truck.

RED BLUFF SPAN COLLAPSES

The collapse of the Sacramento River Bridge at Red Bluff in October, 1936, was described in the newspapers and technical journals at the time it occurred, as was also the failure of the timber arch span over Rock Creek in Mendocino County, which occurred April 21, 1937.

While the failure of the Rock Creek Bridge was discovered before any damage was done to vehicles, it was necessary to stop all heavy traffic for several weeks while a temporary structure was being built across the canyon. This materially affected the hauling of supplies into the communities along the Redwood Highway.

Twice within six weeks, heavy trucks got out of control on the Pit River Bridge, 14 miles north of Redding on the Pacific Highway. In both cases large gasoline trucks were wrecked and caught fire on the bridge causing death or serious injury to the drivers.

The bridge, being of concrete, was not seriously damaged although it is quite likely that its service life may be impaired. If it had been one of the many light steel structures still in use on the State Highway System it would undoubtedly have been demolished. One of the photographs shows the truck after it had burned on the bridge and also shows a considerable length of concrete handrail which was knocked out. The holes in the end of the tank were made by the bullets of traffic officers in an effort to allow the gasoline to escape and prevent a serious explosion.



Yager Creek Bridge in Humboldt County. Note broken end post.

MANY WEAK BRIDGES

Many near failures have occurred. The accompanying photograph shows a vertical member of one of the

(Continued on page 9)

Major Construction Under Way on Coast Highway Through Malibu Ranch

By A. D. GRIFFIN, District Office Engineer

FROM the standpoint of combined recreational, scenic and commercial values, the "Coast Highway," State Highway Route 60, between El Rio in Ventura County and Doheney Park in Orange County, is undoubtedly one of the most important traffic arteries in California. This highway, frequently called the "Roosevelt Highway," and sometimes referred to by the Federal route number designation of "U. S. 101 Alternate," for its entire length of 120 miles follows along the ocean front or in proximity thereto.

During the past fifteen years, as fast as funds could be made available, State highway construction contracts have been carried out opening up sections on new location, or improving existing road facilities so that, with the exception of about twelve miles within the boundaries of the Malibu Ranch, we now have a highway with three or more traffic lanes along the coast on modern high standards of alignment and grade.

FOUR LANES

From Las Flores Canyon, the easterly boundary of the Malibu Ranch, through Santa Monica Bay cities, city of Los Angeles and city of Long Beach to Laguna Beach in Orange County, the pavement has a minimum width of four lanes with ample shoulder width on both sides for the parking of vehicles. For a considerable portion of this distance the pavement is full width between curbs providing for six lanes of moving traffic with lanes adjacent to the curb for the parking of vehicles.

The 12-mile section of the Coast Highway within the Malibu Ranch from Encinal Canyon to Winter Canyon, with its narrow twenty-foot pavement or oiled surfacing, with dangerously sharp and curving alignment and restricted sight distance over vertical curve summits, is the last section of the Coast Highway to come up for improvement. The land through which it passes, while splendid potential subdivision property, is at the present time used for the most part as grazing or agricultural land and there exists little or no local traffic to be served. Therefore, there has not been the resultant pressing need for highway improvement, as has been the case in metropolitan areas where heavy local traffic caused intolerable congestion before capacity was increased.

However, during recent years, through traffic has been steadily increasing. Particularly is this true of commercial traffic because trucking concerns operating between Ventura and Los Angeles have found the Coast Route cheaper and quicker to operate over than the inland routes with their longer and steeper grades.

ORIGINAL LOCATION IN 1921

The original location through the Malibu Ranch was made in 1921 when standards of alignment and grade were much lower than at present. Between Encinal Canyon and Walnut Canyon there are several sections of road on curving alignment dangerous for modern high speed traffic. Some of the curves have radii as short as four hundred feet. As traffic speeds and traffic volume have increased, serious accidents have become more and more frequent, and the need for improvement of the old road to modern standards has become a vital necessity.

The Division of Highways now has two road construction contracts and two bridge construction contracts in progress on the Coast Highway through the Malibu Ranch, which in value total approximately $500,000. The Macco Construction Company of Los Angeles is the contractor for the road work on both contracts between Walnut Canyon and Encinal Canyon, which total 4.78 miles in length, and for which the allotment is $392,000. The contractors for this highway improvement work have concentrated a large amount of heavy grading equipment on the job in order to move as quickly and economically as possible the 473,000 cubic yards of roadway excavation to be handled in making this improvement.

CONSTRUCTION EQUIPMENT

Included in the construction equipment are ten 95 h.p. Caterpillar tractors, seven 14 cubic yard capacity carry-all scrapers, together with several rooters and sheepsfoot rollers. The Macco Construction Company is well equipped to carry out grading operations in accordance with the State Division of Highways standard specifications for placing roadway embankments in thoroughly compacted layers.

Other construction operations started during the short time that work has been in progress consist in the installation of drainage structures, the moving and resetting of property fences and the construction of detour connections and temporary surfacing over new work for the accommodation of public traffic. The specifications require that all construction operations are to be so carried out that the traveling public can move with complete safety through construction with a minimum of inconvenience and delay. To this end all possible use is made of the existing highway. The Macco Construction Company organization is to be commended for its splendid cooperation with the State in the most difficult problem of handling public traffic.

COMPLETION THIS SUMMER

The State Division of Highways is represented on the contract by C. N. Ainley and Earl A. Parker, Resident Engineers, with a staff of experienced assistants. Their estimates indicate that on both contracts all work will be entirely completed early this coming summer.

Concurrently with the two highway contracts, there are also in progress

(Continued on page 22)



Construction scenes on Coast Highway through Malibu Ranch. Upper—Reconstruction at Encinal Canyon to eliminate reversing curves on old alignment. Center—Grading operations with modern heavy equipment to provide eighty-foot width of roadbed. Lower —Looking westerly from Walnut Canyon toward Zuma Creek, showing grading on new alignment.

State Highway Route 26 North of Beaumont Being Realigned

By A. EVERETT SMITH, Assistant Highway Engineer

A PROJECT is now under way on State Highway Route 26 between Beaumont and the Northerly Boundary of Riverside County to correct conditions that slow up traffic movement and tend to create traffic hazards.

At the location of the project, the terrain is composed of high table land cut in numerous places with deep arroyos or washes. Over this a concrete pavement was placed in 1925, constructed to a rolling grade line with winding alignment where necessary to minimize construction costs. However, it was built to engineering standards for that time and was adequate for the light traffic and the 35-mile speed limit.

Recent contract construction under which improvement has been made to other major portions of this route in northern Riverside County has included work on four sections.



Upper—Eliminating dangerous curves on State Highway Route 26. Lower—A seven hundred foot radius curve that will be abolished by new alignment.

WORK STARTED IN 1934

Between January and June in 1934 the Division of Highways had under way a contract for grading and surfacing two miles between Cabazon and Whitewater. This project provided for the elimination of 45 dips which had been placed in the roadbed to carry storm water across the highway. At 42 of these dips the grade of the highway was raised and drainage taken care of by means of bridges and culverts and the others were eliminated by changes in alignment. The old 16-foot concrete pavement, on a 25-foot roadbed, was replaced by plant-mixed oil treated crushed rock surfacing, 36 feet wide, laid on the new raised subgrade.

A year later nearly 17 miles of the existing 16-foot concrete pavement between one mile east of Beaumont and Whitewater was widened to 20 feet and the shoulders widened to eight feet on each side of the pavement.

Between June of 1936 and January, 1937, two short portions were improved between the San Bernardino County line and Beaumont covering a distance of about 2.4 miles. These two sections dovetail with the improvement now under way and the project consisted of changing the grade line to eliminate the short steep pitches at many points so as to provide better sight distance over vertical curves.

A new plant-mixed surfacing 20 feet wide, was placed on the reconstructed roadbed. At locations where the cost of a change in grade was prohibitive, the pavement was constructed 40 feet wide to provide four lanes for traffic, so that passing of the slow moving vehicles was made possible.

The present construction operations are at two separate locations, and are for the purpose of correcting undesirable conditions that still exist.

IMPROVEMENT BENEFITS

The improvement will provide twofold benefits.

1. Alignment improvement: The existing alignment has a 700-foot minimum radius curvature, whereas

the new location will have a minimum radius curvature of 3,000 feet.

2. Gradient improvement: The existing road has numerous short and sharp vertical curves with a maximum grade of 5.94 per cent. The new grade provides for longer and less abrupt vertical curves and a maximum grade of 4.25 per cent.

In addition to the alignment and gradient improvements, the project includes the following features:

A dip will be eliminated over which passes storm water from a branch in the San Timoteo Creek with its resultant deposits of debris entailing hazard to traffic. These storm waters will be carried under the road on new location in a double 10- by 7-foot reenforced concrete box culvert.

The subgrade will be made of sand blended with native material and mixed with oil by the road-mix method. A 38-foot roadbed paved with a 22-foot width of plant-mixed surfacing, bordered by an 8-foot shoulder of road-mix surfacing adjacent to each side will be provided.

Oswald Brothers of Los Angeles are the contractors performing the work included under this contract and construction operations are proceeding satisfactorily with the equipment and crew which they have placed on the job.

LARGE TRAFFIC VOLUME

This route carries a large volume of traffic traveling between the Los Angeles metropolitan area and the Coachella and Imperial Valleys. During seasonal periods, heavy traffic travels between the Los Angeles area and Palm Springs. This also being the main truck route between Los Angeles and the Imperial Valley, numerous trucks and trucks and trailers, many loaded to maximum legal limits, use this route, with a recorded maximum of over 700 in one day. To this is added the constantly increasing number of out of state automobiles, converging on this road from the two transcontinental highways entering California at Blythe and Yuma.

On many highways the improvements as noted above would mean a little more speed, a little more safety, or a little more motoring comfort, but on this route these improvements are particularly significant. Through traffic is very heavy. Trucks, heavily laden, going up the steep grades, shift to lower gears, and consequently progress at very slow speeds.



Upper—Construction on stretch of highway between Redlands and Beaumont. Lower—Highway north of Beaumont looking toward Redlands.

LIMITED SIGHT DISTANCE

Limited sight distances, due to poor alignment and abrupt, vertical curves, make it extremely dangerous for automobiles to pass. The result is that long lines of traffic form behind the slow moving trucks and await a favorable opportunity to pass. Further, the danger element is ever present by the nervous driver who can not wait for proper sight clearance before passing.

With the completion of this construction, the heavy commercial vehicles will move at a more uniform rate of speed by reason of easier grades. Automobiles will have normal opportunities to pass the slower vehicles, due to increased sight distance, and traffic movement in general will be greatly facilitated.

"But, my dear, I haven't spoken for ten minutes."

"No, Henry, but you've been listening in a most aggravating manner, and I'm not going to stand for it."

Old Bridges Are Menace

(Continued from page 5)

trusses on the bridge over the San Benito River near Hollister. This member was struck by a truck with such force that it was practically demolished and, in the process, additional and unusual stresses were caused to the other members of the truss.

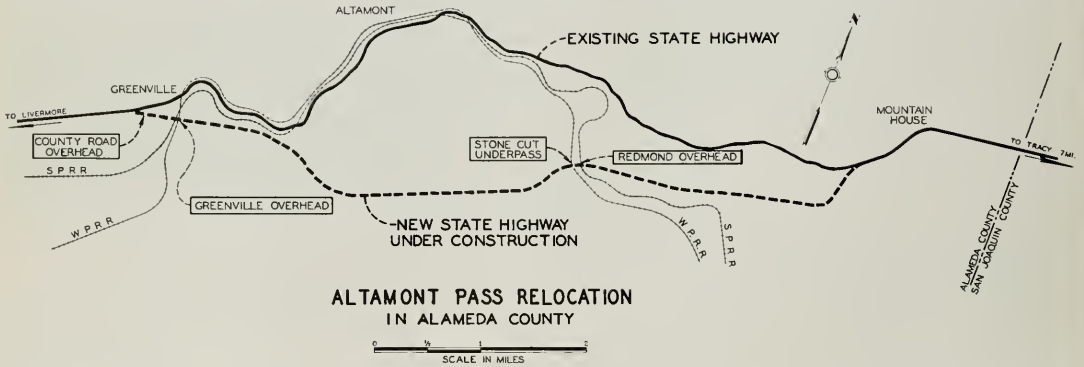
There are over 2000 bridges on the State Highway System which are either weak, narrow, or have dangerous approaches. It will be a period of several years before all such bridges can be replaced. In the meantime it is necessary that the traveling public, and particularly drivers of heavy trucks, use extreme caution in approaching narrow bridges or passing other vehicles on them.

Coxswain—Take this Oar!
Stroke—Oar What?

New Altamont Pass Will Be Ready for Opening of 1938 State Fair

AT THE present rate of progress all indications are that the new route through the Altamont Hills between Livermore and Tracy will be open to traffic by Labor Day, September 5.

The grading work is about 70 per cent complete and the three grade separation structures are 50 per cent complete. Very little of the large scale operations which are under way can be seen from the existing road as the new route follows an entirely different alignment from Mountain House to Greenville, as can be seen by the accompanying route map.



The existing road, which was adequate at the time it was constructed, has for the past few years been unable to satisfy the demands of modern high speed traffic. Because of the limited sight distance and tortuous curves, fast traffic is forced by slow moving vehicles to slow up on the two-way road. Many accidents have occurred on this stretch of road because of attempts by motorists to pass the slow moving traffic. The new road will provide for two lanes of traffic in each direction separated by a four-foot dividing strip.

At Greenville, approximately three miles east of Livermore, the new highway jumps over the tracks of both the Western Pacific and Southern Pacific Railroads at a point where the railroads are close together. The separation of grades is being effected by means of one overhead structure which will span the tracks of both railroads.

At Redmond, or Stone Cut, approximately three miles east of Greenville, the highway again crosses both railroads by passing under the Western Pacific tracks and over the Southern Pacific tracks at a point where the railroad tracks are only a few hundred feet apart but are at a different elevation.

The overhead structure at Greenville provides for two twenty-three foot lanes of highway traffic and two three-foot wide pedestrian walkways. The highway lanes, each of which will accommodate two lines of traffic, will be separated by a center curb four feet in width which will separate traffic in opposite directions.

GREENVILLE OVERHEAD

The Greenville Overhead is being built entirely of reinforced concrete with a total length of 458 feet consisting of eight spans 49 feet in length, one approach span at the west end 50 feet in length and a cantilever approach span at the east end 16 feet in length. The reinforced concrete girders are designed continuous over the supporting columns which are 60 feet in height. Provision is made in the design to provide for the existing track and one future track for both the Western Pacific and Southern Pacific Railroads.

At Redmond the new highway passes under the Western Pacific tracks approximately 40 feet below the grade of the railroad. This necessitated the construction of a reinforced concrete arch to support the railroad tracks and span the double two-lane highway. Each highway lane is 24 feet in width and is separated by a 4-foot center curb which will effectively divide the traffic. Pedestrian walkways are also provided on both sides. The length of the arch barrel is approximately 35 feet, flanked by retaining walls at each end parallel to the highway center line to retain the high railroad embankment.

Several hundred feet from the Western Pacific Underpass the highway crosses over the tracks of the Southern Pacific Railroad by means of a reinforced concrete bridge. The structure is designed continuous over supporting columns and provides two 23-foot highway lanes with a 4-foot dividing strip. The Redmond Overhead will have an overall length of 120 feet consisting of three 32-foot spans with two 12-foot centilever approach spans.

COUNTY ROAD OVERPASS

In addition to the separation of grades between the new highway and the railroad tracks, a separation structure is also provided to carry State Highway traffic over an existing

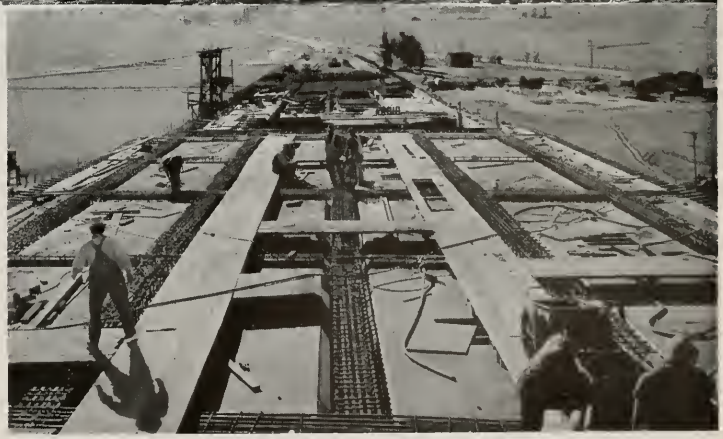


county road at Greenville. Through traffic will thus enjoy complete protection from intersecting traffic.

This structure is of reinforced concrete and provides for two 24-foot roadways separated by a 4-foot dividing strip. Two 3-foot sidewalks provide a safe crossing for pedestrians.

The completed project will cost approximately $1,160,000 of which the railroad separation structures represent an expenditure of $260,000.

Contractors on the three projects are: Mountain House to Greenville, grading and surfacing, Granfield, Farrar and Carlin, San Francisco. Overhead over Southern Pacific and Western Pacific at Greenville, A. J. Raisch, San Francisco. Overhead over Southern Pacific at Redmond and undergrade under Western Pacific at Stone Cut, Heafey-Moore Co., Frederickson & Watson Construction Co., and Frederickson Bros., Oakland.



Construction scenes on Altamont Pass project. Upper—Redmond overhead nearing completion. Center—View of Redmond overhead in foreground and Stone Cut railroad trestle in background. Lower at work on Greenville overhead.

Three Major Improvements on Pacific Highway Completed

By E. J. BASSETT, District Office Engineer

COMPLETION of a series of three major projects on the Pacific Highway entering Redding from the north marked the conclusion of an improvement which has long been under consideration. It accomplished the elimination of an indirect routing and the discarding of a dangerous section of alignment on which numerous casualties of varying degree have been a source of increasing concern during the past 17 years.

The first project of the recent improvement involved the construction of a 795-foot plate girder bridge with a 34-foot concrete deck, and 3-foot sidewalks on each side. Due to the design of the structure, requiring concrete supports set on the approach fills, the end spans were of the cantilever type and were counterbalanced each with two 37,000 pound weights pending the completion of the structure under a subsequent contract. The bridge is supported by seven concrete piers, 108 feet on centers, founded on bedrock, the footings being set into the rock to a depth of from 3 to 6 feet.

SECOND PROJECT

The second project consisting of the grading and paving of 0.91 mile of the new route, from Trinity Street in Redding to Sulphur Creek, was begun in the spring of 1935 and was dedicated and opened to the public on December 18th.

The initial phase of this contract covered the alteration of the southerly channel of the river which was used as a diversion canal by the Anderson-Cottonwood Irrigation District between their dam and tunnel intakes. Plans called for the filling of this channel in building up the southerly approach fill 65 feet in depth, and for the construction of a concrete-lined channel around the toe of slope on the island under the bridge.

Irrigation requirements made the construction of the new channel mandatory before construction of the embankment, which, necessarily, was delayed until completion of the north approach. Excavation was accomplished with a power shovel which dug its own road down the 65-foot river bluff.

WATER CONTROL

The lining of the channel change with Portland cement concrete 6 inches in thickness was accomplished under trying conditions occasioned by the gravelly soil on the island and high spring water levels of the river.

Water from the river channel was excluded by means of earth dykes and the channel change dewatered with two 4-inch and one 6-inch pumps. Weep holes were built into the paved slopes to relieve the hydrostatic pressure during construction. The channel change is 417 feet in length with a 14-foot bottom and minimum 13-foot depth with 1:1 side slopes.

The second phase involved the grading of the roadway north of the river and the construction of the approach fills to the bridge. Material for embankment was obtained principally from gravel bars in the river and from dredger tailings adjacent to the bridge.

APPROACH PROBLEMS

It was necessary that the northerly approach be constructed first as material for the south approach was available only on the north side of the river and must be hauled across the bridge. Access to the structure at the north end was accomplished by means of a temporary wooden span pending construction of the abutment and remaining section of the cantilever span. Material for the south approach was hauled across the bridge and dumped from the end of the suspended span into a stockpile and was moved into place with bulldozers and compacted with a sheep's foot roller and a 10-ton 3-wheel roller. The maximum subsidence of this embankment after two wet winters is 0.5 of a foot.

The widening and paving of that portion of the project on Market Street in the city of Redding constituted the third phase. The existing 50-foot street, which had long been a serious bottleneck on this important highway, was widened to 80 feet with a 56-foot concrete pavement of standard thickness. A paved wye connection was made with Riverside Drive and the intersection at Trinity Street revised and replaced. The removal of dwellings and the replacement of private improvements were done under a cooperative agreement with the city of Redding.

48-FOOT ROADBED

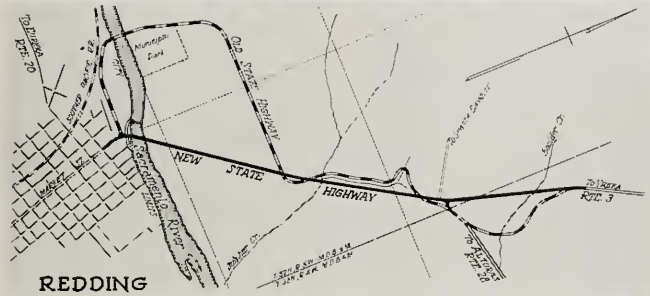
The last phase consisted of paving and finishing north of the river. Gravelly material was used as a subbase across the low-lying flat, followed with a crusher-run base 0.45 foot in thickness and a road-mixed surface course 0.25 of a foot in thickness. The resulting roadbed is 48 feet in width throughout, with a paved width of 32 feet at the northerly bridge head, tapering in 330 feet to a 22-foot pavement for the remaining 3400 feet.

The third project from Sulphur Creek to Boulder Creek Hill, with a revised connection to the Redding-Alturas lateral, was started in September, 1936, and completed in July, 1937. Some delay was experienced during the winter months, but, despite a four months' shutdown, the work was completed within two weeks after the allotted time had expired.

Construction was on entirely new alignment of high standard and relegated to oblivion the crooked and narrow Sulphur Creek grade where many serious accidents had occurred. It also eliminated two short, narrow concrete bridges which were replaced by culverts. The roadbed section provided for a 38.4 foot roadbed with a road-mixed surface 0.21 of a foot in











Scenes on newly completed project on Pacific Highway. 1. New bridge with chain guard in Shasta County. 2. Stretch of recently completed highway in Modoc County. 3. Section of new highway on Sulphur Creek Hill in Shasta County. 4. Street scene entering Alturas on new highway. Center, map of project.

thickness placed on a crusher-run base 0.5 of a foot in thickness. An imported selected material sub-base 0.88 of a foot in depth was placed prior to paving operations over the native red and yellow clay characteristic of the locality.

EXCELLENT ALIGNMENT

The outstanding features of these projects are the high standard of alignment realized; the improvement in roadbed width; the dispatch with which the work was accomplished in slightly over two years; and the saving in distance. By referring to the tabulation, it will be seen that in the first grading project the saving in distance was greater than the length of the new work. For the combined projects the saving is approximately 30 per cent.

Following the contract program a beautification project was set up from Federal funds with an anticipated expenditure of $10,000. The work consisted in part in the construction of a chain guard along both approaches to the bridge and along the wye connecting with Riverside Drive. This improvement not only serves as a safeguard for motorists and pedestrians, but adds a definite artistic touch to the bridge setting.

In addition to the chain guard, extensive plantings of shrubbery on the slopes of the approach, the installation of a watering system and the planting of shade trees along a stretch of 3400 feet north of the bridge give promise of future shade

(Continued on page 23)

Device Accurately Measures Concrete Pavement Volumes

By EARL WITHYCOMBE, Assistant Construction Engineer, and
WILLIAM F. FAUSTMAN, Assistant Engineer

DURING the past several years there has been an apparent need for some means of rapidly and accurately measuring the volumes involved in the placement of Portland cement concrete pavement. Any dependable method that would help to definitely determine the scope of responsibility for yield, or reduce to a minimum the unknown variables, would unquestionably be desirable. When such a device also incorporates the qualities of speed and accuracy with less tedious book checking, it would have a decided advantage.

Such an apparatus, termed a "Volumeter," has recently been designed, built, and used, by C. N. Wilczek, engineering assistant on Contract 87VC17-67VC32, road VII-LA-9-LA, working under the supervision of W. J. Calvin, resident engineer.

HOW DEVICE IS MADE

The device consists essentially of a light wooden or metal beam, spanning the subgrade from side form to side form, on which is mounted a system of compound levers, actuated by "feet" which rest on the subgrade. The levers in turn actuate an indicator on a dial quite similar to that used on a milk scale. The dial is graduated to read directly the volume of concrete per 25-foot length of pavement, corresponding to the depths at the point of measurement.

In order to construct this device, it was necessary to select a straight-grained piece of timber, 2 by 3 inches and 11 feet long. Holes were bored in it edgewise, one near each end and four spaced about 2 feet apart in between. Through these holes, automobile valve stems were inserted to act as feet to rest on the subgrade. To the upper ends of the valve stems were fastened the ends of levers in a compound lever system designed to automatically add or subtract the reading above or below theoretical subgrade, as determined by the relative positions of the six valve "feet."

The resulting component of the lever action is carried through the entire system and summed algebraically in one lever arm in the center. A wing-nut adjustment is built into each half of the lever system by means of which the dial can be set to read normal for any desired section, after the feet have been set in correct relative position.

HOW IT WORKS

A 7-inch dial is used as a registering device, with a revolving hand fastened to a pinion which is in turn actuated by a rack fastened to the central lever arm. The ratio of the pinion is such that the hand makes three complete revolutions within the limits of the rack, which made it difficult to count the revolutions as they occurred. This was overcome by placing a vertical slit in the face of the dial and a small hand on the end of a bolt through the rack. The small hand assumes a definite position up or down the vertical slit for each position of the central lever arm, thus making it possible to tell at a glance the number of revolutions made by the revolving hand.

The dial is calibrated so that one complete revolving represents an average subgrade difference of .02 foot, which is the allowable tolerance. There are three circles of numbers and three corresponding sections on the vertical slit. The inside circle is



Left—Volumeter in use on 10-foot pavement subgrade. Right—C. N. Wilczek, designer, operating Volumeter.

red and represents from normal to .02 foot high. The corresponding section on the slit is also red and is calibrated in half-hundredths, as is the middle white section which is correlated with the outside white circle. The blue circle and section indicate between .02 foot and .04 foot low.

VOLUMETER IS ACCURATE

Thus by noting the position of the small sliding hand the operator knows which of the three circles to read. They are calibrated in hundredths of a cubic yard per 25 feet of pavement and it requires 20 degrees of arc to change the reading .01 cubic yard, which difference represents about .001-foot average variation of subgrade.

Numerous tests were made against a string, and in every instance where the measurements were made to the nearest quarter of a hundredth, the "Volumeter" checked precisely. Although it was checked before and after each time used, it was never found to be out of adjustment after having been once set.

SLIGHT VARIATIONS

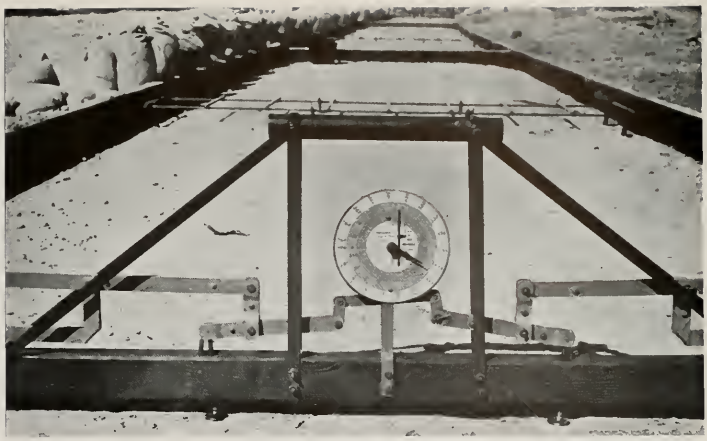
In four check tests for accuracy, in which various individuals operated the machine, the results were as follows:

In the first test, 700 feet, there was .33 cubic yard difference in the two totals of about 155¼ cubic yards, or 0.21 per cent variation. The second test, 1250 feet long, showed .18 cubic yard difference in the two totals of about 285½ cubic yards, or about 0.06 per cent variation. The third test, 600 feet long, registered .25 cubic yard difference in two totals of about 140½ cubic yards, or 0.18 per cent variation. The fourth test showed a difference of .25 cubic yard in two totals of about 395 cubic yards in a distance of 1800 feet which gave 0.06 per cent variation.

In only one instance was the check test made by the same individual who ran the original test and in this case the results were the poorest. It is obvious that the human factor has no effect on the readings.

The subgrade conditions in the second test were much better than in the other three. Also the fact that the error is not cumulative makes the shorter tests more severe.

In point of time, one man can easily and accurately determine the volume contained in a half mile of subgrade in one hour and actually measure it every 25 feet.



Closeup view of Volumeter showing the design of its construction.

EXCEPTIONS

The point has been raised that were the grade to be .02 foot high on one foot and .02 low on another, the "Volumeter" would register normal and thus fail to locate high grade, which is quite true. There are two reasons why no provision was made for the apparatus to register such conditions. In the first place the specifications require the use of the scratch templet. Secondly, the present-day methods of cutting subgrade with a machine preclude the probability of any great extent of subgrade being cut to such extremes. Therefore, the slight advantage to be gained did not warrant the additional complication in design.

On the contract where the "Volumeter" was first tried out, Mr. Wilczek was assigned as plant assistant. Using the absolute volume method of determining the theoretical batch weight, he has found that indications thus far make it appear necessary to add approximately 0.5 per cent to the "Volumeter" quantities to obtain proper yield: presumably to allow for any additional amount required because of slight waste or variation on the finish.

ADVANTAGES OF DEVICE

The apparent advantages in the use of this device are as follows:

Variations because of personal differences are eliminated, and the calculations of one person can readily be checked by another.

The device is exceedingly accurate and fast.

It requires less book recording and checking.

It is quite simple to operate and relatively foolproof.

Its action is positive. If the operator has checked the adjustments, and is willing to glance at the feet and two suspension arms, to eliminate any chance of poor contact with the subgrade or side forms, he knows the reading must be correct.

Another important advantage is that by using the "Volumeter" and having accurate batch weights, the size of the batch need not be changed after having once been carefully determined. And finally, the results are unquestionably more satisfactory to both the contractor and the engineer for the reason that any disagreement as to quantities is practically eliminated. It is a well-established fact that no two men "stab" alike when ordinary methods are used.

Inasmuch as this first machine was designed for 10-foot pavement, the problem now is to make one that will stretch from eleven to twelve feet, and back again at will, for use on the proposed new lane widths. This should be merely a problem of further study in design, and it is believed that the use of the "Volumeter" is another step forward in pavement construction methods.

New Wilson Way Underpass in Stockton Is Open to Traffic

WITH impressive dedicatory ceremonies conducted by the Native Sons of the Golden West order, with Eldred L. Meyer of Santa Monica, Grand President, presiding, followed by talks by Governor Frank F. Merriam and Director of Public Works Earl Lee Kelly, the recently completed Wilson Way Underpass in Stockton was thrown open to the public on Saturday morning, February 19, 1938.

San Joaquin County and city officials joined with representatives of the State administration and the Division of Highways in commemorating the occasion.

The Governor in his talk stressed the need of safety in the building of roads. He said while many highways are constructed at tremendous expense, they soon pay for themselves through reduced mileage and lessened operating expense to users. He added that such highways could not be built in the future unless gasoline tax funds are zealously guarded and diversion of them to purposes other than highway construction and maintenance is prevented.

Following the dedication the guests were entertained at a luncheon in the Hotel Wolf. Mayor Ralph W. Fay presided and talks were given by Mr. Kelly and Governor Merriam.

The underpass carries State traffic on U. S. 99 and U. S. 50 under the tracks of The Atchison, Topeka and Santa Fe Railroad.

Wilson Way serves to by-pass the business district and carries traffic on both U. S. 99, which is the principal north and south artery in the interior valley of California, and on U. S. 50, which coincides with U. S. 99 from Sacramento to Stockton and through this new underpass and then turns west on Charter Way and through the underpass completed last year under the Southern Pacific and Western Pacific railroads.

The signing by President Roosevelt of the Emergency Relief Appropriation Act of 1935, made available funds for expenditure of Works Progress grade separations. Wilson Way Underpass is one of the structures now completed by the State under this act.

TWO 24-FOOT ROADWAYS

The crossing consists of a depressed portion 906 feet in length, providing two 24-foot roadways separated by a five-foot safety curb and two 4-foot 6-inch pedestrian sidewalks, all flanked by retaining walls the full length of the depressed portion.

Reinforced concrete construction was used throughout with the exception of the spans carrying the railroad tracks which are made of steel.

Division of the roadway area into two two-lane roadways by means of the safety curb, is in accordance with modern safety practice, providing as it does two traffic lanes for vehicles traveling in the same direction.

The safety curb also becomes of economic value, for it permitted the use of intermediate piers to support the vehicular bridge and track span superstructure. Had it been necessary to span the entire roadway from retaining wall to retaining wall much heavier bridge superstructure would have been required with consequent increased cost.

SAFETY PRECAUTIONS

Another feature of this structure which increased the safety to through traffic was the extension of the safety curb for a distance of between 250 and 300 feet each way from the depressed portion; this making it impossible for traffic to cross directly in front of the depressed portion or turn into the underpass until through



Wilson Way Underpass in Stockton which was dedicated by Governor Frank F. Merriam on February 19, 1938.



Governor Merriam cuts ribbon at Wilson Way dedication. Left to right: Edward J. Neron, Deputy Director of Public Works; District Highway Engineer R. E. Pierce, Brigadier General H. H. Morehead, Harry A. Hopkins, Chairman California Highway Commission; George T. McCoy, Assistant State Highway Engineer; Senator Bradford S. Crittenden, Director of Public Works Earl Lee Kelly, Governor Frank F. Merriam, Mayor Ralph W. Fay, Jr., of Stockton, George H. Moore, State Printer; Assemblyman Chas. M. Weber, Eldred L. Meyer, Grand President, Native Sons.

traffic is clear of the blind part of the structure.

As is usual in the case of undergrade crossing structures, with depressed portions below natural ground line, drainage of water entering the roadway had to be provided for. To this end two electrically operated pumping units, to operate alternately, were provided to pump from a sump located below the point of lowest grade line.

To provide additional safety for night traffic adequate lighting equipment to illuminate the roadway for the entire length of the depressed portion has been provided. For illuminating the roadway areas outside the limits of the vehicular bridge and track spans, electroliers supported on the retaining walls flanking the roadway are provided, and for the areas beneath the vehicular bridge and track spans superstructure, lighting units mounted in recesses cast in abutments and piers have been provided.

The total construction cost for the underpass is approximately $250,000, including the cost of engineering.

All necessary rights of way for the project were furnished by the city of Stockton and San Joaquin County, the latter providing $25,000 of the total required sum of $100,000.

The highway was constructed by the State Division of Highways under contract with Earl W. Heple, of San Jose.

C. L. Sweet was resident engineer, representing the Bridge Department of the Division of Highways.

J. W. Vickrey to Head New Department

(Continued from page 1)

might lead to a reduction of this appalling death rate. There can be no question but what the problem of highway safety in all its possible aspects, including the driver's part, is vitally linked with a highway department."

Proffering their cooperation, Mr. Fred D. Parr of San Francisco, president of the California Safety Council; Mr. Franklin Lowney of Los Angeles, executive vice president; and Mr. Paul H. Buehholz of San Francisco came to Sacramento to participate in the official launching of the new safety engineering department of the Division of Highways.

Bay Bridge Traffic Decreases

A DROP in February traffic of approximately 78,000 vehicles crossing the San Francisco-Oakland Bay Bridge from the previous month's total was revealed in a report filed by State Highway Engineer C. H. Purcell with State Director of Public Works Earl Lee Kelly. February's total was 594,378 as compared to 672,433 for January.

Total for February a year ago was 667,563 vehicles, showing a decrease of approximately 73,000 vehicles during last month from the corresponding period in 1937.

Sixteen days of bad weather in a 28-day month were factors in February's reduced traffic. Low point occurred on February 13, a Sunday, when 17,617 vehicles crossed the span. High point was on Sunday, February 27, with 25,742 vehicles. February 9, the day of the heavy wind, 19,116 vehicles used the bridge. The daily average was 21,228 vehicles.

The only classification of vehicles to show an increase last month over January was tricars, when a total number of 845 used the span, compared to 798 in the preceding month.

Comparative figures follow:

	Total Jan.	Total Feb.	Total Since Opening
Passenger Autos	633,115	558,239	11,120,381
Auto Trailers	649	513	18,678
Motorcycles	2,117	1,497	39,931
Tricars	798	845	10,745
Trucks	24,239	22,983	374,327
Truck Trailers	883	878	24,218
Buses	10,632	9,423	123,140
Total Vehicles	672,433	594,378	11,711,420
Extra Passengers	170,440	146,941	2,543,459
Freight Lbs.	55,840,498	54,078,501	858,115,019

Problem of Slipouts Studied By State Highway Engineers

By A. W. ROOT, District Materials Engineer

THE large maintenance expenditure involved in the repair and correction of embankment failures, commonly referred to as "slipouts," along the Redwood Highway and other routes in District I, has led to a careful study and analysis of this particularly aggravating and perplexing problem.

Special attention is now being given to the prevention of these slipouts during the design of all grading projects and it is the practice to make foundation investigations wherever a heavy fill is proposed, and particularly where a slide area is traversed. This investigation is conducted by the District Materials Engineer, and consists of a study of drainage and soil formation, together with subsurface conditions obtained by soil tube borings. The necessary treatment is then designed for each individual case and included in the construction plans.

CAUSES OF SLIPOUTS

There are several distinct causes of slipouts, probably the most common being that the shearing strength of the foundation soil is so low that the weight of the fill causes lateral movement. As the low shearing strength of the soil is usually the result of excess water, the fill foundation may often be stabilized by the installation of proper drainage structures. The project discussed below is an example of such a case.

In 1934 a survey was made for relocation of a portion of the Redwood Highway from Trinidad to McNeill's Ranch, Road I-Hum-1-J. At that time the existing highway crossed Mill Creek just north of Trinidad, on a circuitous route with a series of very sharp curves. It was proposed to eliminate these hazardous curves by crossing the creek on a direct route on a line with a long tangent at the northerly side of the creek. This line, however, crossed a large active slipout on the south slope of Mill Creek which included part of the existing traveled way and extended down the slope almost to the creek. As the slipout in the existing road was active it was apparent that the foundation would not support the proposed heavy fill without special treatment.



View across Mill Creek, Humboldt County, showing course of new road alignment.

TRESTLE IDEA ABANDONED

Consideration was given to constructing a timber trestle across this unstable area but the estimated, approximate cost of $50,000 for such a structure was prohibitive as it was impossible to decrease the quantity of roadway excavation without greatly lowering the standards of alignment and grade. Design was therefore continued on the embankment type of construction across Mill Creek, with foundation stabilization for the high fill which would have a maximum height of 52 feet at centerline.

Borings were made during April, 1935, to determine soil conditions and locate subsurface water. The location of the borings is shown on the accompanying sketch, the profile showing the depth of those holes located along centerline.

The borings indicated that the slide was relatively shallow, consisting of a mass of saturated, plastic, stony, bluish-gray clay overlying a firm, soft, gray shale formation. Water appeared to be entering the clay stratum from the hillside to the right, making it soft and unstable and creating hydrodynamic pressure which aggravated the lateral movement.

SYSTEM OF DRAINS

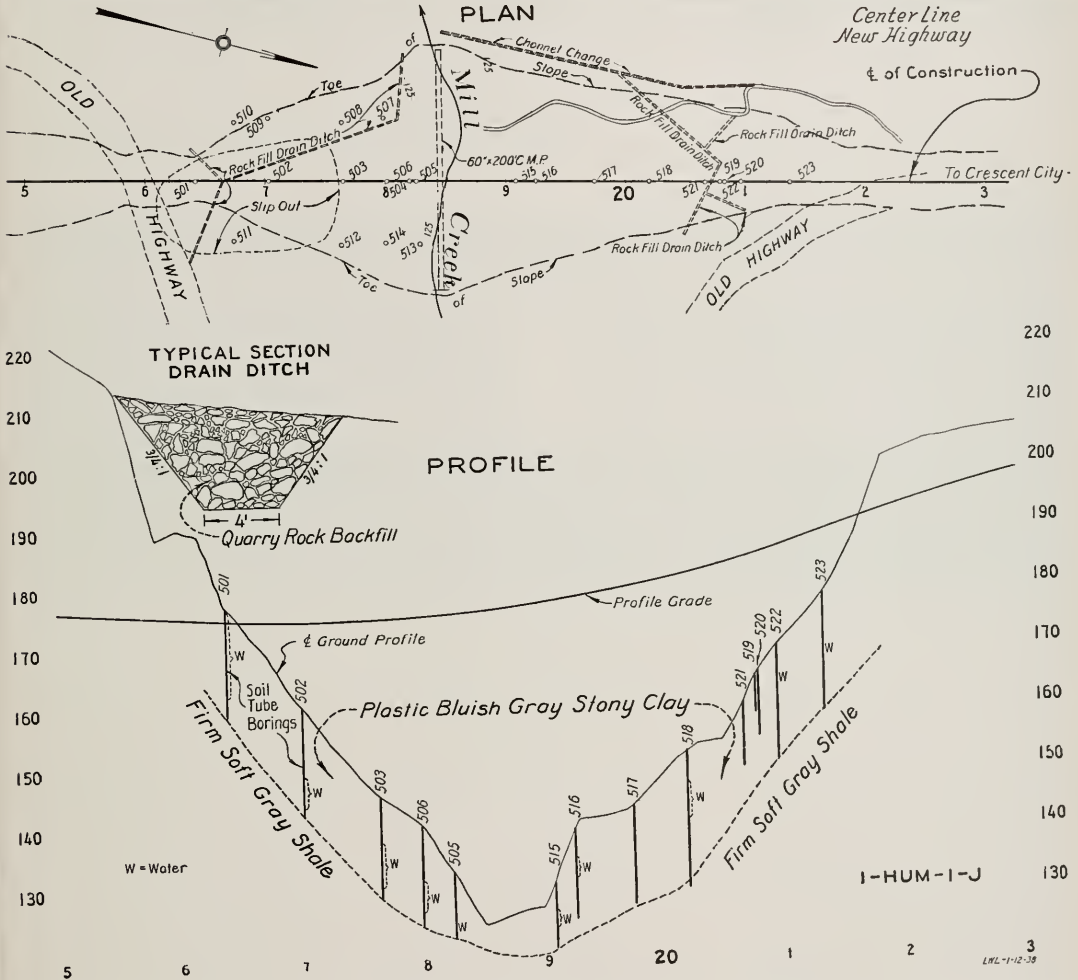
From the data thus obtained, a system of drains was designed to provide outlets for the water and to partially dehydrate the wet stratum of clay. This drainage was planned as part of the grading and surfacing contract on which bids were received January 13, 1937.

Work was started on the contract in January, 1937, and the drainage system at Mill Creek, constructed as shown on the sketch, was completed in May, 1937. The drainage treatment was completed substantially according to the preliminary plans and consisted of 305 lineal feet of rock-filled drainage ditch with an average depth of 16 feet on the south slope of the creek, and 226 lineal feet on the north slope, with average depth of six feet.

The trenches were excavated with dragline and backfilled with clean quarry rock from three to twenty-four inches in diameter. When the trenches were first opened up, a large amount of impounded water was

PROPERTY OF

Rock Fill Drain Ditch Method of Preventing Slipouts



released but after standing a short time there was only a small flow of water in the ditches, making it possible to eliminate the perforated metal pipes usually placed in such drainage ditches.

FILL WITHSTANDS STORM

The total cost of the foundation stabilization under this fill (which contains 48,500 cubic yards) was $3,330, which was somewhat lower than the preliminary estimate, as firm material was encountered in a portion of the ditches at lesser depth than originally contemplated. The contract was completed in October, 1937, and after a winter of unusually heavy rainfall there has been no movement of this fill.

Similar corrective treatment is being applied to other unstable areas in the district, on which fills are to be constructed, the method of attack being based on a detailed study of each location.

It is believed that by thorough preliminary investigation, especially by means of borings, and a carefully planned drainage treatment most of the costly slipouts so costly to the Division of Highways can be prevented in the future.

CONCRETE PAVEMENT SLAB WARP AND ITS PREVENTION

By C. S. POPE, Construction Engineer

This is the second of two articles dealing with highway concrete pavement distortion and measures for its prevention and relief. Accompanying this article is a table showing projects on which warp was prevented by the use of subgrade treatment and membrane seal.



Device developed by Division of Highways for measuring amount of pavement warp at expansion joints. This pavement in Orange County has a 4-inch select material base, but no membrane. The joints are much improved since 1934.

THE value of the membrane seal type of highway construction under which, because of the expansive nature of the soil, a membrane seal of heavy asphaltic oil is placed under a layer of imported borrow on which the Portland cement concrete pavement is constructed is shown in the tabulation of projects so constructed in various districts, entitled "Projects on Which Warp was Prevented by Use of Subgrade Treatment and Membrane Seal."

The significance of roughness records shown on the accompanying tabulation as taken by roughometers used by the California Division of Highways is approximately as follows:

Index of 10 or under is a very smooth pavement producing little or no vibration in a car at any speed—riding comfort, 90-100.

Index of 15 is such a surface as is obtained on a well finished asphalt concrete—roughness perceptible—riding comfort, 75-90.

Index of 25 indicates a poorly finished surface—quite rough for concrete, and roughness quite marked—riding comfort, 60-75.

Index of 35—many city streets show this degree of roughness—side sway often quite marked—riding comfort, 50-75.

Index of 50—very poor surface, high joints, or other defects, riding comfort less than 50 in a scale of 100.

SELECTED EXAMPLES

Selected examples of the effect of the membrane in controlling moisture content are shown by the following:

L.A-60-Tor & D is reported as having an average distortion of one-tenth inch at joints which is practically negligible. The selected material placed over the membrane showed a moisture content of about 11 per cent and the subsoil under the membrane a moisture content of about 22 per cent. The presence of the membrane and the imported borrow undoubtedly protected the subgrade from any local increase in moisture due to leaky joints and made unnecessary any extra care in pouring the expansion joints to keep them well sealed.

On project, L.A-168-B & C, a section on rather sandy soil was laid without seal but with a layer of imported borrow to increase the bearing power of the material under the pavement slab. The movement of the slab ranged from .02 inch to .17 inch, and the moisture content in the selected material being about 10 per cent and in the subsoil about 20 per cent. On another section of the same project where expansive soil was present, a bituminous seal $\frac{1}{4}$ inch in thickness was placed under the imported borrow and the movement was reported as ranging from between .02 inch to .09 inch, with a moisture content in the selected material as high as 12 per cent and in the subsoil about 27 per cent.

The device developed in District VII by J. M. Lackey, Assistant Construction Engineer, for measuring the

amount of warp at expansion joints is also shown.

EXPANSION JOINTS

Minnesota reports that seepage drains constructed under expansion joints proved unsuccessful in preventing the movement of joints and this concurs with the California experience on similar construction.

Experience also confirms the value of equalizing the moisture under the entire length of the slab. The determinations of density of subgrade soil and its relation to moisture content as undertaken in Minnesota points the way to a very interesting phase of this work.

The practice in California is to obtain the relative density of the soil of the subgrades as constructed, which means that the weight of the soil in the subgrade is compared with the maximum weight which can be obtained for a sample compacted to a standard density.

It is quite likely that investigation along the lines of obtaining relative densities of soils of varying moisture content will shed considerable light on the proper density to which soils should be compacted in using the proper moisture content, since the moisture content, as we know, affects not only the bearing power of the soil but also its swell and a rational balance between the importance of these two factors would, no doubt, lead to better design.

It is to be pointed out in the California construction that the swell or shrinkage of subgrade under the impervious membrane, except as it affects bearing power, is more or less

(Continued on page 28)

PROJECTS ON WHICH WARP WAS RELIEVED OR PREVENTED BY USE OF SUBGRADE TREATMENT AND MEMBRANE SEAL

Date	County-Route-Section	Soil designation and characteristics					Thickness Imp. borrow	Bituminous membrane		Roughness index		Warp Oct., 1937
		Kind	Shrink	Swell	Bearing power			Grade	Amount	On Compl.	Oct., 1937	
					Wet	Dry						
	None											
1931	Col-7-B, C*	Clay	5 to 7%		Not recorded		12"	None	None	13.7 to 35±		Slight
1933	Ala-5-B	Adobe, clay, etc.	4.5				4" cr. run	94±		17.5		None
1933	SCl-68-A, B	Adobe, clay, silt	6.4				4" cr. run	90-95	0.5 gal.	12.2		Slight
1933	SCl-68-B	Adobe	10±				12"	90-95	0.5 gal.	11.9		None
1934	SCl-2-P.A.	Adobe, clay	3.4				12"	90-95	0.5 gal.	7.2		Slight
1934	S.B.-2-J	Adobe	5.0	7.0%			9"	E	0.5 gal.	4.7		0.12" max.
1935	S.B.-2-D, E	Shale, clay	6.0				9"	E	0.7 gal.	9.0		0.12" max.
1936	S.B.-2-F	Adobe, clay, shale	5.6	5.5	25#	85#	9"	E	0.7 gal.	5.2		0.12" max.
1937	Mon-2-H, I	Adobe	2.9	4.7	17	88	9"	E	0.7 gal.			0.12" max.
1933	Ker-4-A	Adobe	5.0				9"	90-95	0.6 gal.	7.1		None
1935	Ker-4-F	Clay	2.1	4.3			12"	E	0.5 gal.			None
1933	L.A.-19-B	Adobe, clay	5.0				10"	E	0.75 gal.	11.1	8-10	0.03-0.04"
1035	Ora-43-B	Clay		4.8	9	121	12"	E	0.7 gal.	5.6	7.4	
1935	L.A.-60-D	Clay		4.5	6	70	12"	E	0.5 gal.	9.6	18.6	0.07-0.12"
1936	Ora-43-B	Adobe	3.5	8.1	4	256	12"	E	0.7 gal.	7.1	13.0	None
1936	L.A.-172-C	Adobe	3.0	7.0	5.2	154	18"	E	0.65 gal.	12.0	16.1	None
1936	L.A-158-LA, B	Adobe		1.4	10.5	145	12"	E	0.7 gal.	5.5	16.1	Slight
1936	Ven-60-A	Adobe		3.7	12.0	154	12"	E	0.7 gal.	7.8	5.8 to 8.5	None
1936	L.A-Ora-171	Adobe	4.2	6.3	3.0	168	12"	90-95				Slight
1937	L.A-168-A	Adobe		5.5	6.0	140	12"	E	0.7 gal.			None
1937	Ven-2-B (a)	Adobe	7.5	6-20	4.5	380	24" adobe	3" plant-mix envelope				None
	Ven-2-B (b)	Adobe	7.5	6-20	4.5	380	24" adobe	90-95 membrane envelope				None
1937	L.A-9-A	Adobe		6-7.3	7.5	160	8"	E	0.7 gal.			None
1937	L.A-178-A	Adobe	1.4	5.4	6.0	186	8"	E	0.7 gal.			None
	None											
	None											
1936	Sol, Nap-7-8-F, G, H, A	Adobe, clay, shale	6.2	12.0	Not recorded		18"	E	0.4 gal.	25.9		None reported
1937	Sol-7-C, Vac,D	Adverse	5.4	12.5	3	84	18"	E	0.4 gal.			None reported
1937	S.D-12-S.D	Clay	3.6	7.0	3	54	9"	E	0.5 gal.			None reported

* This project is the Williams project described in text. Roughness varied as shown in first year. Warp previous to treatment varied from 0.5 inch to 1.0 inch.

New Construction on Coast Highway

(Continued from page 6)

two bridge reconstruction and widening projects. John Strona of Pomona is the contractor for the reconstruction of the Zuma Creek Bridge and the Trancas Creek Bridge. H. R. Lindicke is the State's Resident Engineer on this bridge project, for which the construction allotment is $35,000 and the date of completion March 30, 1938.

J. S. Metzger and Son of Los Angeles is the contractor for the widening of the Corral Creek Bridge, the Solstice Creek Bridge and the Escondido Creek Bridge, which work is under the supervision of Resident Engineer G. H. Miller. The construction allotment for this bridge project is $47,000, and date of completion is August 1, 1938.

NARROW BRIDGES WIDENED

All five existing narrow bridges are to be widened to a uniform width of 76 feet between curbs, and two three-foot wide sidewalks are provided on both sides of the roadway for the use of pedestrians. A central dividing strip four feet wide on the bridge roadway is a part of the bridge reconstruction to fit in with the divided roadway design for the adjacent highway improvement.

The central dividing island will consist of two Portland cement concrete curbs spaced four feet apart with a one-inch plant-mixed surfacing between them. The purpose of the plant-mixed surfacing is to prevent weeds from growing in this area and also to shut off surface water which might otherwise soak into the subgrade below to the detriment of the adjoining surfacing and pavement.

DOUBLE TRAFFIC STRIPES

In some locations where business and residential developments have already started on abutting property and where further private improvements are anticipated in the near future, the separating strip with the raised curbs will be omitted. In its place two double traffic stripes, four feet apart, will be painted, and raised white arrows, over which traffic can easily cross, will be constructed between the traffic stripes. This is the type of construction which we have used with considerable success on other projects in Los Angeles County under similar conditions where construction of a curbed central dividing strip would be inappropriate.

Twelve-foot widths of plant-mixed surfacing are being provided adjacent to the central dividing strip, and adjoining this plant-mixed surfacing eleven-foot strips of Portland cement concrete pavement of standard 0.75-foot-0.55-foot-0.75-foot cross-section are planned.

Wherever it is possible so to do, old existing twenty-foot wide Portland cement concrete pavement is preserved and utilized by second-storying and widening operations so that it will fit in with the planned fifty-foot total width of pavement and surfacing. Throughout the project earth shoulders and roadway gutters will be oil treated and tops of cut slopes will be rounded.

RIBBON OF WHITE

Mabel Miller Freeman

At break of day we motored away
With a jest and a lilt of song.
No thought gave we to that ribbon of white
Dividing the traffic from left to right,
As we merrily motored along.

Through a bank of fog at eventide
Our steps we retraced that night.
With landmarks gone, and we alone,
How thankful then for that ribbon of white,
A light to guide us home.

At life's glad morn, so careless and free,
No thoughts for landmarks, we;
But when shadows fall, at death's drear night,
Faith in our God is the ribbon of white
That leads to Eternity.

(Gratefully dedicated to the person who originated the idea of the painted white line on the boulevards.)

SCENIC VIEW PROVIDED

There is one feature in connection with the new location between Encinal Canyon and Trancas Creek which should be particularly commented upon. In this two-mile section we had the choice of carrying out new construction following approximately along the existing highway, which for a considerable distance is on low-lying beach land, or to adopt a new alignment somewhat landward and at a considerably higher elevation.

It was decided to carry out construction on the "High Line," because this would make possible the creation of a perpetual view out over the ocean for travelers on the highway. Had the construction been carried out revamping the existing highway along the beach, it would have been only a few years before the erection of beach residences, garages and other private improvements on the ocean side of the highway would have completely shut off most of the view of the ocean.

Before final decision was made to adopt the "High Line," the matter was taken up with Mr. T. R. Cadwalader, trustee in federal bankruptcy proceedings for the Marblehead Land Company, the owners of the Malibu Ranch. After careful studies of the situation on the ground, Mr. Cadwalader and his associates arranged for the restriction of all future building operations on the area between the new "High Line" location and the existing highway, so that view southerly from the highway to the shore line of the Pacific Ocean would never be obscured.

OCEAN PANORAMA

This portion of the work over the "High Line" route between Encinal Canyon and Trancas Canyon, with the "daylighting" of all cut banks between the highway and the ocean, has now been completed. As one rides over the newly graded roadway, one is impressed by the scenic beauty of the ocean panorama and the justification for the "High Line" con-

(Continued on page 28)

New Geyser Is Attraction on Inyo Highway

STATE Highway District IX has a geyser of its own. On December 17, 1937, there was a rumbling in the vicinity of Casa Diablo, which lies approximately 45 miles north of Bishop, and a full fledged geyser broke forth approximately 350 feet from the center line of Route 23, which is the Los Angeles to Reno highway.

Since that date it has continued unabated, throwing its plumy spray to a height of 80 feet. During the cold weather the spray froze as it hit the ground and formed the beautiful figures which can be seen in the picture. Luckily the prevailing winds have only in a few instances veered to such an extent as to cause this spray to descend upon the highway and freeze. Maintenance men of the Division of Highways keep a close watch at this point so that in the event the spray does freeze on the highway, suitable protective measures can be taken.

The area adjacent to this geyser contains many hot springs and small vents which discharge steam and peculiar odors into the atmosphere. At the base of this geyser there existed an old Indian hot spring that for many years has been used as a steam bath.

IMPROVEMENTS ON PACIFIC HIGHWAY COMPLETED

(Continued from page 13)

and beauty for residents and tourists alike.

A comparison of pertinent features of this series of projects follows:

	Cost	Length	Deg. Length	Curvature Old No.
Bridge Project	$163,392			4
1st Grading Project	96,686	1.05	1.10	
2d Grading Project	105,705	1.77	0.27	15
Beautification	10,011			
	$375,794	2.82	1.37	

	Curvature			Min. Radii	
	Old Deg.	New No.	New Deg.	Old	New
Bridge Project					
1st Grading Project	320°	1	56°	50′	500′
2d Grading Project	760°	2	57°	130′	2500′
Beautification					



Views of geyser in action on State Highway Route 23. Note ice creations formed by freezing spray and proximity of geyser to highway.

Truck Checking Station Opened on Ridge Route

BUILT primarily to insure safety for traffic over the new Ridge Route between Los Angeles and the San Joaquin Valley, a complete weighing and truck checking station has been established by the Division of Highways, to be operated by the State Highway Patrol.

Located at the head of the Grapevine grade into the San Joaquin Valley, this station will not only guard against overweight loads. but will also enable the traffic officers to insure that trucks using this mountain route are in good order, and that all their braking equipment is working properly.

HUGE WEIGHING SCALES

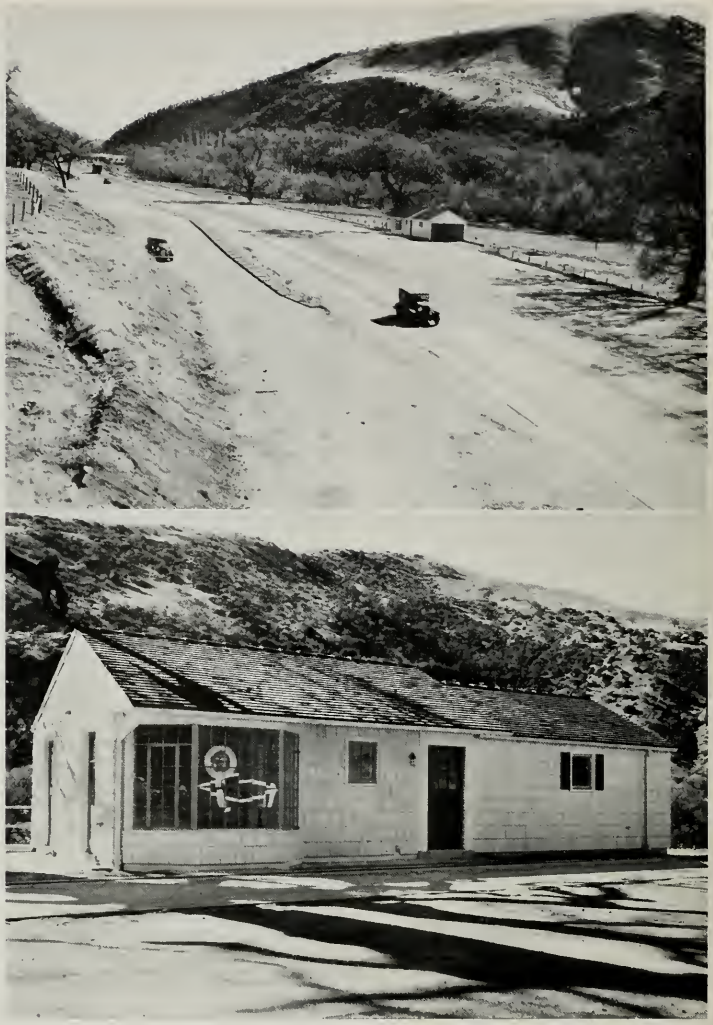
Since the location is somewhat remote from any town and a 24-hour use is planned, the weigh house, designed by the Division of Architecture, provides not only an office for the scale dials, but a 12 by 14 foot room, which may be used as quarters for the patrolmen, and a 16 by 20 foot garage for their machines. The house is heated by gas, taken from the neighboring pipe lines, and water is supplied from a well, with a continuous pressure system.

The scales have a large recording dial, visible through the window of the house and will stamp the registered weight on a record card. The dial records to 80,000 pounds, and in addition to this, the scales can weigh up to 130,000 pounds, which amply covers the maximum load of 68,000 pounds for any combination of vehicles and loads specified by the State law. The scales have a truck platform 60 feet long.

PARKING FACILITIES

Since the California law requires that brake tests be made on a grade of less than 1 per cent, a level Portland cement concrete lane 10 feet wide and 250 feet long was constructed on a road at the side of the main highway. In addition to the main traveled way at this point, which has a Portland cement pavement an area of approximately three acres was paved with a light layer of bituminous treated rock to provide ample parking facilities and permit the scale house to be set well back from the highway traffic.

The original plans for this station were made at the time that the highway was graded past this point, and completion of the scales now makes this complete facility available for the patrolmen. Plans are now being made for flood-lighting of the entire area, which will include mercury vapor mazda lights over the scale house, and sodium vapor lights to illuminate the parking grounds and brake testing runway.



General view of weighing and brake testing station near Fort Tejon in Kern County. Roadway on left protected by guard rail is provided for brake testing runway. Lower—Closeup view of scale house, showing dial clearly visible from outside the house.

Nearly twice as many automobiles and trucks are in use in the United States as there are telephones. Latest 1937 estimates place the automobile registration close to 30,000,000 while telephones number 15,200,000.

Highway Bids and Awards for February, 1938

CALAVERAS, STANISLAUS, TUOLUMNE and AMADOR COUNTIES—Diesel Oil to be applied to Roadside vegetation, a length of 175.5 roadside miles. District X, Routes 5, 13, 34, 54, 65, various sections. J. P. Breen, Sacramento, $3,500; Lee J. Immel, Berkeley, $3,575; Oilfields Truck Co., Bakersfield, $4,725. Contract awarded to Sheldon Oil Co., Suisun, $3,112.50.

HUMBOLDT COUNTY—Six miles south of Scotia, a reinforced concrete slab bridge across Jordan Creek consisting of 6—22 ft. spans, 1—24 ft. span and 1—15 ft. span on concrete piers with steel pile foundations to be constructed, and approximately 0.19 mile to be graded and surfaced with Plant Mixed Surfacing. District I, Route 1, Sections D, E. Earl W. Heple, San Jose, $38,403.75; Poulos & McEwen & M. A. Jenkins, Sacramento, $38,756.25; Mercer-Fraser Co., Eureka, $41,758.50; A. Soda & Son, Oakland, $41,794; John Burman & Sons, Eureka, $44,970; F. J. Maurer & Son, Inc., Eureka, $45,325.25. Contract awarded to E. E. Smith, Eureka, $36,917.

LASSEN COUNTY—Construct three timber bridges with concrete decks on concrete pile bents on Buntingville-Wendel Road. District II, Lassen Feeder Road, Section FAS No. 10. Franzini & Fredenburg, San Rafael, $13,575.50; J. P. Brennan, Redding, $14,011.50; A. Soda & Son, Oakland, $14,901; John Rocca, San Rafael, $15,131; W. K. Van Bokkelen Construction, Oakland, $16,499. Contract awarded to M. A. Jenkins, Sacramento, $12,539.50.

MADERA COUNTY—Four miles south of Madera, reinforced concrete bridge across Cottonwood Creek Overflow. District VI, Route 126, Section A. E. S. and N. S. Johnson, Pasadena, $9,416; Palo Alto Road Materials Co., Palo Alto, $8,850; A. Soda and Son, Oakland, $9,737; J. S. Metzger & Son, Los Angeles, $8,664; Valley Construction Co., San Jose, $9,436. Contract awarded to Franzini & Fredenburg, San Rafael, $7,998.50.

MARIN COUNTY—Between San Geronimo and one mile north of Fairfax, about 1.5 miles in length to be graded and surfaced with armor coat. District IV, Feeder Road. Poulos & McEwen, Sacramento, $68,997; Macco Construction Co., Clearwater, $78,720; A. Teichert & Son Inc., Sacramento, $99,446; J. L. Conner and Sons, Monterey, $77,384; Johnston Rock Co., Stockton, $94,976; Chas. L. Harney, San Francisco, $83,688.40; Pimbo Bros. & Co., San Francisco, $66,999.90; Rock & Gravel Trucking Co., Oakland, $89,081.80; Eaton & Smith, San Francisco, $82,197.60; Young & Son Company, Ltd., Berkeley, $83,525.40; Fredericksen & Westbrook, Lower Lake, $67,831.50; N. M. Ball Sons, Berkeley, $77,869.60; Guy F. Atkinson Company, San Francisco, $89,914. Contract awarded to Granfield, Farrar & Carlin, San Francisco, $63,943.

MERCED COUNTY—Between 1.7 miles east of Los Banos and easterly boundary about 8.9 miles in length, to be graded and untreated crushed gravel or stone borders to be constructed. District X, Route 32, Section C. J. A. Casson, Hayward, $147,590.20; Union Paving Co., San Francisco, $180,330.50; Granite Construction Company, Ltd., Watsonville, $159,344.80; Claude C. Wood, Stockton, $166,729.80; Warren Southwest Inc., Los Angeles, $162,466.10; Piazza and Huntley, San Jose, $149,256.35. Contract awarded to Fredericksen & Westbrook, Lower Lake, $144,472.35.

NAPA COUNTY—Between Oakville and Calistoga, about 6.2 miles in length, to be graded and surfaced with crusher run base and Armor Coat. District IV, Silverado Trail. Granfield, Farrar & Carlin, San Francisco, $73,576; Harold Smith, St. Helena, $58,534; Claude C. Wood, Stockton, $63,366.80; J. R. Reeves, Sacramento, $66,593.25; A. Teichert & Son, Inc., Sacramento, $69,837.80; E. A. Forde, San Anselmo, $64,009.60; Poulos & McEwen, Sacramento, $61,367; Piazza & Huntley, San Jose, $70,891.45. Contract awarded to Rock and Gravel Trucking Co., Oakland, $54,363.50.

ORANGE COUNTY—Between Orange and Olive, about 1.0 mile in length to be graded and paved with Portland Cement Concrete. District VII, Route 181, Section A. Claude Fisher Co., Ltd., Los Angeles, $44,250; Sully-Miller Contracting Co., Long Beach, $44,928.95; Los Angeles Paving Co., Los Angeles, $42,990.20; Dimmitt & Taylor, Los Angeles, $46,356.50; E. L. Yeager, Riverside, $51,902.50; United Concrete Pipe Corp., Los Angeles, $43,815; Warren Southwest, Inc., Los Angeles, $42,192.50; B. G Carroll, San Diego, $40,486.25; Griffith Co., Los Angeles, $41,923.60; Geo. R. Curtis Paving Co., Los Angeles, $41,187.50; Ansco Construction Co., Inc., Long Beach, $42,198.20; J. E. Haddock, Ltd., Pasadena, $39,236.75. Contract awarded to Vido Kovacevich, South Gate, $38,929.

SAN BENITO COUNTY—Between Paicines and Tres Pinos, about 4.7 miles in length to be graded and Road Mix surface treatment and Class "B" seal coat applied. District V, Route 119, Sections D, E. Geo. K. Thompson & Co., Los Angeles, $90,701.40; Union Paving Co., San Francisco, $84,745.50; Granfield, Farrar & Carlin, San Francisco, $80,701.30; Claude C. Wood, Stockton, $82,046.10; Pearson, Minnis & Moody, Los Angeles, $83,280.50; Poulos & McEwen, Sacramento, $84,079; Piazza & Huntley, San Jose, $87,262.70; L. C. Karstedt, Watsonville, $87,357.10; Mountain Const. Co., Sacramento, $89,911.45; Earl W. Heple, San Jose, $96,499.90; Harms, Bros., Litchfield, $93,359.90; C. F. Robbins, Los Angeles, $87,542.60; J. L. Conner and Sons, Monterey, $72,896.45 ; A. S. Vinnell Co., Alhambra, $107,100.85; Young & Son Company, Ltd., Berkeley, $72,860.50. Contract awarded to N. M. Ball Sons, Berkeley, $72,758.

SAN DIEGO COUNTY—On Douglas Street, in the city of San Diego, betwcen Eagle Street and University Avenue, about 0.2 mile in length to be graded and surfaced with Plant-mixed surfacing. District XI, Route San Diego, Section City Street. Harry L. Foster, San Diego, $22,312.75; R. E. Hazard & Son, San Diego, $18,721.25; B. G. Carroll, San Diego, $18,979.50. Contract awarded to V. R. Dennis Const. Co., San Diego, $16,885.30.

SAN LUIS OBISPO COUNTY—A timber bridge across San Juan Creek about 38 miles east of Santa Margarita, consisting of 16—19' 0" spans on pile bents, and about 0.3 mile of roadway to be graded and road mix surface treatment applied. District V, Route 58, Section C. Earl W. Heple, San Jose, $25,616; Valley Construction Co., San Jose, $24,916; Edward Green, Los Angeles, $26,800; V. R. Dennis Construction Co., San Diego, $27,497.50; A. Soda & Son, Oakland, $28,626.50; Rexroth & Rexroth, Bakersfield, $28,684.50; R. R. Bishop, Long Beach, $33,963.30; J. E. Burrell & Son, Long Beach, $35,078.07. Contract awarded to S. A. Cummings, San Diego, $23,898.

SANTA CLARA COUNTY—A reinforced concrete overhead structure over Madrone Drive, about 5 miles south of Los Gatos consisting of 1—43' 1" span, 1—50' 0" span and 1—41' 1" span on R. C. Bents and abutments. District IV, Route 5, Section C. Palo Alto Road Materials Co., Palo Alto, $36,280.30; Carl N. Swenson Co., San Jose, $38,787.70; W. K. Van Bakkelen Construction, Oakland, $38,841; Heafey-Moore Co., & Fredrickson & Watson Construction Co., Oakland, $39,468; A. Soda and Son, Oakland, $40,799; Earl W. Heple, San Jose, $40,506; F. Kaus, Stockton, $41,191; B. A. Howkins & Co., San Francisco, $41,197; E. T. Lesure, Oakland, $41,818; Guy F. Atkinson Company, San Francisco, $42,529; Peter J. McHugh, San Francisco, $43,671.20; Albert H. Siemer & John Carcano, San Anselmo, $44,098; A. J. Raisch, San Jose, $44,540.50; John Rocca, San Rafael, $45,947; F. C. Amoroso & Sons, San Francisco, $49,902.52. Contract awarded to C. W. Caletti & Co., San Rafael, $36,031.

VENTURA COUNTY—At Big Sycamore Creek about 0.7 mile in length, to be graded and paved with Portland Cement Concrete. District VII, Route 60, Section A. Dimmitt & Taylor, Los Angeles, $97,510.50; Claude Fisher Co., Ltd., Los Angeles, $84,496; Geo. J. Bock Co., Los Angeles, $75,923.75; Geo. R. Curtis Paving Co., Los Angeles, $85,020.50; United Conc. Pipe Co., Los Angeles, $94,629.95; Los Angeles Paving Co., Los Angeles, $84,400; J. E. Haddock, Ltd., Pasadena, $80,724. Contract awarded to Macco Construction Co., Clearwater, $75,862.25.

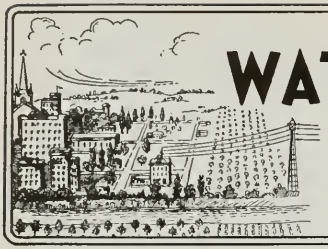
VENTURA COUNTY—Between La Cross and Oakview, about 1.7 miles in length to be graded and paved with Portland Cement Concrete. District VII, Route 138, Section A. United Conc. Pipe Corp., Los Angeles, $119,602; Los Angeles Paving Co., Los Angeles, $132,273.80; C. R. Butterfield-Kennedy Co., San Pedro, $108,870; Geo. J. Bock Co., Los Angeles, $99,430.50; A. S. Vinnell Co., Alhambra, $119,100; Claude Fisher Co., Ltd., Los Angeles, $103,081.50; Basich Bros., Torrance, $99,744.80; Pearson-Minnis & Moddy, Los Angeles, $91,797; C. O. Sparks & Mundo Eng. Co., Los Angeles, $94,233; Macco Const. Co., Clearwater, $107,676.50; Griffith Co., Los Angeles, $110,417.50; Geo. K. Thompson Co., Los Angeles, $132,931; Geo. R. Curtis Pavg. Co., Los Angeles, $95,914.50; Oswald Bros., Los Angeles, $108,027. Contract awarded to J. E. Haddock Ltd., & Crow Bros., Const. Co., Pasadena, $89,825.25.

A young boy, undergoing an examination for a position, came across the question, "What is the distance of the earth from the sun?" He wrote his answer as follows: "I am unable to state accurately, but I don't believe the sun is near enough to interfere with a proper performance of my duties if I get this clerkship."

He got it.

Customer—I like this dog but I think his legs are too short.

Storekeeper—Too short? Why they touch the ground, don't they?



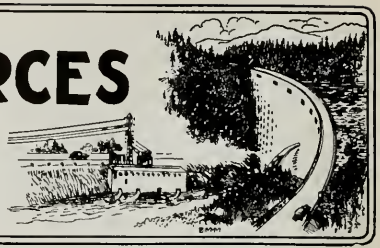
DIVISION OF WATER RESOURCES

OFFICIAL REPORT

FOR THE MONTH OF

February, 1938

EDWARD HYATT, State Engineer



CONSTRUCTION work by the Bureau of Reclamation on the Project was somewhat delayed by weather conditions. However, work was continued and considerable progress made on the construction of the Contra Costa Canal and the government camp for the Shasta dam. The opening of bids for a diversion tunnel and temporary relocation of the Southern Pacific Railroad at the Shasta dam site, which had been set for February 21st, was postponed to March 14, 1938, due to a delay in the determination of wage scales for the work. Bids were opened during the month for pumping equipment for Contra Costa Canal and for materials for the lining of the first section of this canal.

IRRIGATION DISTRICTS

Annual reports on the operation of irrigation districts for the past year are now being received which indicate generally improved conditions throughout the State. Despite the severe freezes of January, 1937, and continued cold spring weather, conditions during the remainder of the season were favorable for growing and harvesting of crops. Total precipitation for 1937 was 122% and total snowfall 152% of the 41 year average, thus affording ample water for irrigation.

WATER RIGHTS

Supervision of Appropriation of Water.

Eleven applications to appropriate were received during January, 22 were approved and 6 were denied. During the month 18 permits were revoked and the rights under 9 permits were confirmed by the issuance of license. Since October 1st, 1146 reports have been received from permittees and 477 reports have been received from licensees. These are in process of study with a view to determining the proper course of action.

SACRAMENTO-SAN JOAQUIN WATER SUPERVISION

During the past month activities have been wholly in the office assembling the field data gathered during the summer months in order to compile a report showing the diversions, acreage irrigated, stream and return flows in the Sacramento and San Joaquin Valleys.

The sampling of water in the delta for salinity is being carried on at all regular stations to record the retreat of salinity.

CALIFORNIA COOPERATIVE SNOW SURVEYS

In the latter part of January and early February the first snow surveys of the season were made at key courses throughout the major drainage basins on the west side of the Sierra. Those snow surveys made on January 25, 26 and 27 showed that a definite shortage in the snow pack existed at that time, the water content at most of the snow courses surveyed being but one-half of the normal supply for that time of the year. On January 28th the first of a succession of storms arrived from the Gulf of Alaska, and for almost three weeks the snow pack in the Sierra was added to daily.

Measurements made on the 6th, 7th, and 8th of February showed that the snow pack in most of the watersheds was up to normal, and although no further surveys have been made since then, the fact that there was considerable snowfall after the last surveys were made, would indicate that healthy conditions maintain as regards the amount of snow pack for this season of the year.

Precipitation records for various sections of the State compiled to the end of January indicated an excess of precipitation so far this season in most of the watersheds north of the Tehachapi Range, with a shortage of about 35% in Southern California.

FLOOD CONTROL AND RECLAMATION

Maintenance of Sacramento Flood Control Project.

This period was marked by a series of storms commencing on January 29th and extending to date, with short periods of fair weather following the 15th. Very heavy winds occurred in the period February 16th to 21st. The streams and by-passes were all at fairly high stage, necessitating heavy patrols and some work for emergency protection. Payroll during this period was heavier than at any other time since this office has been in charge of project maintenance. All of the project works were successfully cared for, but considerable damage was done to the east Sutter By-pass levee by wave wash, sections of a number of bridges were floated out, and the dyke at the lower end of the east levee borrow pit was washed out.

The Sacramento weir gates were opened at 10:30 a.m. on February 11th, when the Sacramento River gage at I Street read 27.7. The water at Sacramento fell one foot during the first hour the gates were open, and at 1:00 p.m. was at 26.1 on the gage, after which it fell slowly. Closure of the gates commenced on March 3d.

Relief Labor Work.

During this period about 70 relief laborers have been employed in patrolling levees, removing debris and miscellaneous emergency work.

Emergency Levee Repairs.

The continued rain during this period delayed greatly the completion of the emergency levee repairs under Executive Order No. E 177. At this date the work is approximately 40 per cent complete and is proceeding as the weather will permit. Work has been completed at Robinson Bend on the Feather River, at the Phelan ranch on the Sacramento River in Butte County, and on the Little Chico Creek. Good progress is being made in the closure of breaks on Antelope Creek and at Gerber, and on Battle Creek in Tehama County.

Flood Damage Survey.

The State Engineer has been requested to survey and report on flood protective works and the cost of making emergency repairs thereto. This office has been assigned the collection of data in thirteen northerly counties of the Sacramento Valley, including San Joaquin, Contra Costa and Solano. This work is well under way and a report will be submitted on March 5th.

February, 1938, Storm and Flood.

The rainfall commencing on January 29th resulted in some fairly high flood stages, the height at Colusa reaching the same as in the December flood. The crest heights reached were as follows: Red Bluff, 20.5 on February 3d; Colusa, 25.3 on the 4th; Red Bluff, 24.85 on the 8th; Colusa, 26.9 on the 11th; Knights Landing, 32.0 on the 12th; Red Bluff, 23.1 on the 14th; and Colusa, 26.2 on the 15th. The Sacramento River at the I Street Bridge was at relatively high stage all during the month of February, 13.5 on the 1st, 20.1 on the 28th, and crested at 27.7 on the 11th. The opening of the Sacramento weir gates on the 11th within a short time reduced the height to 26.1. The American River was relatively low, cresting at 15.1 at Folsom on February 11th.



Sacramento River flood waters pour into Yolo Bypass through Sacramento weir on morning of February 11.

FLOOD FIGHTERS SAVE LEVEES

(Continued from page 2)

partment, the Reclamation Board, nor the Division of Water Resources had authority to make expenditures and where there was no organized reclamation or levee district.

Butte, Glenn, Shasta, and Tehama were the counties hardest hit in this respect. Seeing that it was necessary to take action on their own behalf, each of these counties organized a flood control committee and from these four committees there was made up a super-committee to facilitate cooperative action. This committee made a complete survey of the damage that had to be repaired. With this data on hand, a delegation was sent to Sacramento to plead their case before Governor Merriam, urging him to declare the necessary repair work an emergency which should be financed from State funds.

At the State Capitol the delegates found a sympathetic listener. After investigation by the State Engineer, the Governor determined to issue an order for $150,000 on the State Emergency Fund to be applied to the closing of levee breaks on the Sacramento and Feather rivers and their tributaries. The fund was made available to the Division of Water Resources on January 15, 1938.

Actual construction in the field was commenced on January 16 under the supervision of Col. A. M. Barton, Reclamation Board, and State Engineer Edward Hyatt, Bureau of Water Resources, with Robert L. Jones, Deputy State Engineer in charge.

FIFTY-SEVEN BREAKS

On January 17 the Division of Water Resources opened an office in Chico in charge of Martin H. Blote, Associate Hydraulic Engineer, to facilitate supervision of work at the various points. The necessary equipment was rented and the work proceeded. There were some fifty-seven breaks to be filled, some of them on the main rivers and some on tributary creeks, but with the amount of equipment available it looked as though a few weeks should see the work completed.

Unfavorable weather, however, had still to be reckoned with. Another storm broke and the upper Sacramento again rose to flood stages. By this time some of the breaks had been completely closed, many more had not been touched; but the largest of them all, a 1200-foot break on the Sacramento River near Chico was partially filled.

It would be disastrous to have the water top this fill, move out the new material and inundate a second time. To prevent such an occurrence, large crews of men worked day and night filling sacks with earth and building them into a barrier to hold back the steadily rising water. Inch by inch the water rose and inch by inch the barrier was built up to keep ahead of it.

WORK PROGRESSING

After many exhausting hours of labor under the most adverse conditions, when the flood finally reached its crest, the waves were lapping over the top of that quivering mass of mud which in some places was as much as nine feet in height. It had just sufficient stability to hold up against the pressure and fortunate it was that the tide turned when it did.

Needless to say, this storm greatly impeded the progress of the work even after recession of the high water. Granted a continuance of the present favorable weather, a few more weeks will see all the breaks closed and the levees in condition to withstand the next high water.

Since the original storm, rains have delayed the completion of the levee repairs by twenty-two days.

Concrete Pavement Slab Warp and Its Prevention

(Continued from page 21)

unimportant, if such swell or shrinkage occurs throughout the entire lineal dimension of the highway, and not in localized alternate locations such as occurs where expansion joints are allowed to feed the subgrade with fresh moisture from time to time.

CONCLUSIONS DERIVED FROM STUDIES

1. Pavement warp or distortion occurs after each increase or decrease in moisture content of *adverse soils* and is more or less continuous. (Adverse soil is a term used herein to describe any soil which will change volume with the addition or subtraction of contained moisture.)

2. Texas reports many miles of pavement laid on adverse soil warp badly at joints and elsewhere at times.

3. Minnesota reports 9 per cent of its concrete pavements warps either from ice lenses or swelling soils.

4. This State also reports that if soil is already at plastic limit, additional water will not swell the soil but ice lenses which will distort the pavement will form.

5. Drainage trenches under expansion joints proved ineffective to prevent warp in tests made in Minnesota, Missouri, and California.

6. Equalizing moisture in subgrade of adverse soils reduced warp in Missouri, Kansas, Minnesota, Texas, and California.

7. Heavy impervious paper laid on adverse subgrade in contact with pavement proved of no value since rupture of the paper often occurred at joints which then admitted water.

8. Oil mixed with adverse soil (grade not given) increased moisture holding capacity and swell of soil.—Minnesota.

9. Tar at 1½ gallons per square yard laid on adverse subgrade in contact with pavement proved of no value in Minnesota, as did heavy asphaltic oil, Grade E, in California since rupture of this type of membrane at joints admitted water.

10. Gravel 12 inches to 24 inches thick under pavements in Minnesota prevent warp but in California 12 inches of gravel proved ineffective at Williams, and it is thought that 18 inches to 24 inches will be needed on bad soil if membrane is not used.

11. Copper seals at joints were ineffective in Minnesota and California to prevent leakage at joints and subsequent warp of pavement.

12. Warp has been prevented in Kansas and Missouri by keeping subgrade of adverse soils at plastic limit moisture content.

13. Warp has been reduced in Minnesota by repouring expansion joints with softer asphalts. California found such treatment not permanent where asphalt seals are used.

14. California has prevented warp, where due to moisture change in adverse soil, by constructing a bituminous blanket of 7/10 gallon per square yard of E grade asphalt on the subfoundation, covering same with a rolled course of nonswelling imported borrow usually 9 inches thick, and constructing concrete pavement thereon.

15. California has relieved warped concrete pavements by bringing the subfoundation to uniform moisture content or by placing on the pavement a cushion course of nonswelling, well-cemented crusher run base not less than 4 inches in thickness and constructing thereon a surface of not less than 3 inches of cut-back plant-mix or asphalt concrete.



Five-tenths gallon asphalt membrane under 12-inch imported borrow. Here for several hundred feet joints were from 0.07 inch to 0.12 inch high. Weakened plane joints were the highest.

NEW CONSTRUCTION ON COAST HIGHWAY

(Continued from page 22)

struction with the ocean view perpetually guaranteed is fully substantiated.

When the new highway through the Malibu Ranch is completed between Walnut Canyon and Encinal Canyon early next summer, the traveling public will have a modern, divided highway of high standard, which should put an end to the tragic and distressing accidents which have all too frequently occurred in the past upon the old road. This new highway will provide a safe and enjoyable ocean drive, of which the State Division of Highways organization can justly be proud.

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Main Line Railroad Bridge across Los Angeles River Wrecked by Flood

Official Journal of the Department of Public Works

APRIL · · 1938

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CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways of the Department of Public Works, State of California

EARL LEE KELLY, Director C. H. PURCELL, State Highway Engineer JOHN W. HOWE, Editor K. C. ADAMS, Associate Editor

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Disastrous Winter Floods Caused $8,000,000 Damage to State Highways and Bridges

March Storms Took Big Toll

By T. H. DENNIS
Maintenance Engineer

THREE separate storms during the period December 11 to March 4, damaged State highways and structures to the extent of $8,000,000.

December and February storms took their heaviest toll in the northern part of the State, while the March storm concentrated on the southern section. The damage for the entire period, however, was almost equally divided between the two areas.

December and March storms, which caused over 90 per cent of the damage, were of three to five days duration and brought rains of cloudburst proportions to the higher altitudes, while establishing record-breaking hourly and daily precipitation records in the valley and coastal regions.

The March storm, which this article describes, swept in from a low-pressure area over the Pacific which extended from the Aleutian Islands south to a point about 800 miles west of San Francisco. Los Angeles, Orange, Riverside, Ventura, and San Bernardino counties suffered the brunt of its attack.

TORRENTIAL RAINS

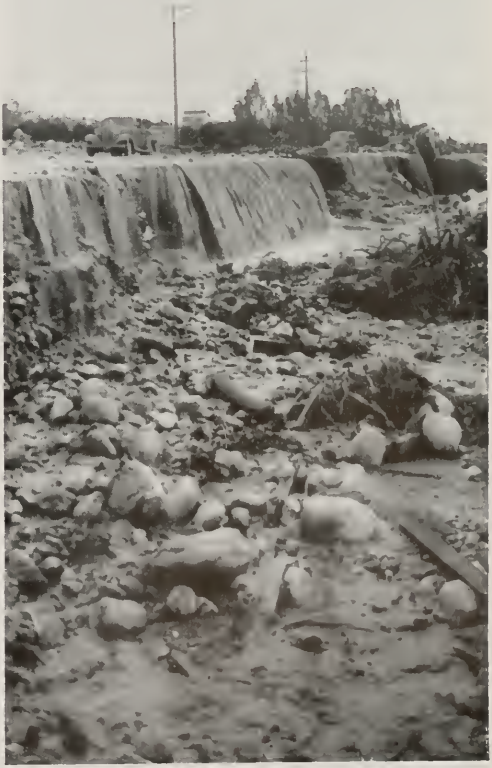
Heaviest rains centered in the San Bernardino and San Gabriel mountains, northerly of San Bernardino and Pasadena, where a total of 30.49 inches for the storm was recorded at Lake Arrowhead, and 10.89 inches during an 8-hour period at Camp Opids in the upper reaches of the San Gabriel. The city of Los Angeles reported 11.06 inches for the storm, 5.55 inches of which fell within a 24-hour period on March 2.

The rainfall data clearly indicate the increasing precipitation as the storm neared the mountains. For instance, Long Beach reported some 6.99 inches of rain for the storm period; Huntington Park 9.48 inches; Los Angeles 11.06 inches; and Azusa 14.95 inches. Again, Newport Beach reported 5.95 inches; San Bernardino 9.82 inches; Devils Canyon 13.65 inches; Waterman Canyon 22.10 inches; and Lake Arrowhead 30.49 inches. The counties of Santa Barbara and San Luis Obispo to the north of the storm center, as well as San Diego to the south, shared to a lesser degree in the storm damage.

RIVERS LEAVE BANKS

The effect of this downpour was immediately evident. The normally dry stream beds on these mountain slopes, tributary to the Santa Clara, San Gabriel, Santa Ana, Mojave and Whitewater rivers, were soon raging torrents. The main rivers, swollen to flood proportions by this sudden influx, overtopped their banks, creating flood conditions unprecedented since 1884. In the resulting chaos, lives were lost, property destroyed and lines of communication and transportation either damaged or disrupted.

In such a battle no quarter is asked or given. Failures of services under such conditions deserve no censure, as the law of economics must govern man's constructive efforts. There remained, however, the supreme test upon which judgment will always be passed; namely, the ability to recover and function under such punishment.



Waterfall on Foothill Boulevard in San Bernardino County caused by flood waters of Cucamonga Creek.



High waters in Barton Wash ripped away timber wing on this bridge on Route 168-C in Los Angeles County.

When it is known that, within two days after the storm, travel was again moving over many of our highways—even though mountains had moved, bridges washed out, and pavements and embankments slipped away—you will acknowledge that the highway forces had justified their ideals of organization and service.

Men and equipment—owned and rented—were worked without stint from the time the storm broke, so that relief might be forthcoming when the danger was past. Had not this been done, the disrupted rail lines, telephone and telegraph service, as well as the broken gas mains, might still be under repair lacking the opportunity of reaching the damaged areas.

Long lines of buses plied the highways transferring railroad passengers around damaged tracks and bridges, to their destination. Trucks loaded with poles and wire were in constant evidence on our roads, speeding out to repair and replace the lines. At one time the telephone, telegraph and teletype communication to coast points was so drastically congested or interrupted that the Federal Communications Commission lifted a certain ban on amateur radio operators to supply this service. The gas companies at several locations utilized bridge structures to hang temporary gas mains pending their permanent replacement.

WHERE DAMAGE OCCURRED

The storm, as previously mentioned, dealt with varying severity throughout the southern counties. In order that its effect and attendant problems may be visualized, a brief account is given of what happened to our highways in each district.

A glance at the maps, in which is indicated in solid dark portions the various kinds of damage, will also prove enlightening. (Pages 7 and 11.)

In District VIII

Beginning with District VIII, which includes Riverside and San Bernardino counties, the heaviest damage occurred on the highways leading to the Lake Arrowhead, Big Bear Lake and Barton Flats resort areas; on the Highland, Foothill, Valley and Mission boulevards westerly of San Bernardino; and on the highways in the vicinity of Palm Springs, as well as on the National Old Trails Highway at Cajon Pass and Barstow.

Lytle Creek, joined by the waters of Cajon Creek at the base of the mountains, was responsible for the great damage suffered by San Bernardino and Colton. Overtopping its banks north of Highland Avenue, State Route 190, the water proceeded southerly, tearing out homes and auto courts as well as claiming several lives, until it reached Foothill Boulevard, State Route 9. Here the river poured into one of its old channels, completely covering the highway and isolating San Bernardino from Los Angeles; also, tearing out the steel bridge of the Santa Fe Railroad and the approaches to the bridge of the Pacific Electric Interurban Railroad.

SAN BERNARDINO HIT

The flood waters following the main channel continued through the southwest portion of the city of San Bernardino, ripping out bridges and homes, until they reached the vicinity of the famous National Orange Show building, where they destroyed auto courts, covered the highway with silt to a depth of six feet, and washed out some 1800 feet of our embankment on Route 26 at the southerly entrance to San Bernardino. At this point, Lytle and Warm creeks joined in their rush to the Santa Ana River,

forming a half-mile wide channel which completely covered highways and farms.

The waters of Lytle Creek, which broke over into one of its overflow channels, raged through the easterly portion of Colton, closing our Route 26. By this time, Lytle Creek and its tributary side canyons had washed out portions of the Cajon Pass and damaged the Verdemont Subway on Route 31. Here, too, it washed out or buried the Union Pacific and Santa Fe's mainline tracks with sand, rock, and debris. Effecting complete isolation, it also washed out the Pacific Electric and Southern Pacific lines.

SANTA ANA RIVER RAMPAGES

The Santa Ana River, originating in the mountains at the easterly end of San Bernardino Valley, picked up new life from large side canyons and reached a peak flood stage at Orange Avenue, State Route 190, north of Redlands.

All road crossings above this point were washed out. Here the river spread northward, inundating one mile of our highway. Further south it breached the southerly approach fill to the highway bridge on Route 26 at the south entrance to San Bernardino, washing it out for a width of 150 feet. There, joined by both Lytle and Warm creeks, it overtopped the fill of the highway on Route 26 connecting the cities of Redlands and Colton. Approximately 600 feet of this fill was carried away, but the three bridges there remained undamaged.

On its way westward, the Santa Ana crossed Highway Routes 43, 19, 193, and 77 in District VIII. Only two of the structures on these routes succumbed to the flood—one at Norco on Route 193, the other at Prado on Route 77. The Norco structure was completely destroyed. This was an obsolete bridge, posted for weight restriction, which was taken into the State System in 1933 by legislative action. The Prado structure, like that at Norco, was county-constructed and taken into the system by legislative action.

Praise from South

March 18, 1938

Mr. Earl Lee Kelly, Director Department of Public Works, Public Works Bldg., Sacramento, California.

Dear Earl:

Yesterday I made the round trip from San Diego to Los Angeles going up via Capistrano through Anaheim and returning in the evening down the Coast Route.

I was absolutely both amazed and surprised at the work which the State Highway Department has done in such a short time, following the storm, returning these highways back to such a splendid condition for traveling. It is certainly a wonderful testimony to you as head of the Department of Public Works, your associates and the maintenance men in the Highway Department for their ability and speed in keeping the highways open and making them passable under such extraordinary conditions. MORE POWER TO YOU.

With kind personal regards, I am

Yours very truly,

H. E. RHOADES, President, The San Diego Club

Below—Views of the Santa Ana River at the State Highway Bridge on the Los Angeles-San Diego route (U. S. 101) near the city of Santa Ana taken before and during the peak of the flood. The bridge was not damaged.

All State-constructed bridges over the Santa Ana River in District VIII, as well as the two county-constructed bridges over Routes 43 and 190, withstood the flood.

MOJAVE RIVER OUT OF BED

While the Santa Ana River, Lytle Creek, Warm Creek and their tributaries were wreaking havoc in and around San Bernardino, Colton and Riverside, the Mojave River—which runs through the Mojave Desert to empty into Cronese Valley and Soda Lake at Baker—was doing its share of heavy damage.

At the narrows, southerly of Victorville, the tracks of the Santa Fe and Union Pacific railroads were washed out and all bottom lands inundated. At Barstow the river went completely out of its channel, around historic Buzzard Rock north of the town, destroying some 6000 feet of our highways on State Routes 31 and 59. At Baker on Route 31, the junction with Route 127 to Death Valley, flood waters doubled the width of the channel and tied up all traffic.

North of San Bernardino, the "Rim of the World Drive"—our Routes 43, 59 and 189—to Lake Arrowhead and Big Bear was severely damaged by slides and slipouts. Saturated to plastic state by some 30 inches of rainfall, high embankments settled and moved down the canyons, while sections in cuts folded together, closing miles of these roads.

TONS OF DEBRIS

Westerly of San Bernardino, Cucamonga Wash and San Antonio Wash tore out sections of Highland Avenue, Foothill Boulevard, Valley Boulevard and Mission Boulevard—our State Routes 190, 9, 26 and 19. These washes, heading back in the mountains, overtopped their banks and deposited thousands of yards of debris and boulders upon the highways, blocking all traffic. Owl Creek Wash, east of Banning, left its banks, carry-











Scenes of Highway Damage by March Storm in Southern California

1. Shoulder washed out and pavement undermined on State Highway 26 by flood waters of Santa Ana River near San Bernardino city limits.
2. Canton Creek usually a placid little stream went wild and tore out a large section of embankment and pavement of Ridge Route Alternate near Piru Gorge.
3. A raging flood rushed down from the San Bernardino Mountain range through Cajon Canyon washing out a large section of the National Old Trails Highway (U. S. 66) in Cajon Pass.
4. Normally an insignificant stream, Placerita Creek whirled with mighty force around a bend and scoured out over 10,000 cubic yards of the Newhall-Saugus highway in Los Angeles County.
5. Warm Creek rose out of its banks and cut a new channel that entirely washed away a portion of State Highway No. 26 between Redlands and Colton.
6. Another large section of the Ridge Route Alternate in Los Angeles County was washed out when Piru Creek scoured away paved slopes.
7. San Antonio Wash crossed the Foothill Boulevard near the west San Bernardino County line destroying shoulders and pavement and depositing a mass of large boulders.











Raging Streams Obliterated Many Miles of Roadway and Pavement

8. Lytle Creek inundated areas in vicinity of Colton in San Bernardino County leaving autos stuck in silt on State Highway 26.
9. Rushing through Santa Ana Canyon in Orange County, the Santa Ana River changed its course and washed out State Highway construction that will cost more than $100,000 to restore.
10. Garapito Creek coursing through Topanga Canyon in Los Angeles County gouged out a large portion of Highway 156.
11. Small streams from the slopes of the Santa Susana Mountains made a wild torrent of Gavin Creek that destroyed part of Route 4 in Weldon Canyon.
12. The Big Tujunga Wash which crosses the route of State Highway 9 near Sunland wreaked destruction on roads and bridges.
13. Embankment was washed out together with half the Newhall-Saugus highway when a creek became a river.
14. The flood roaring down Santa Monica Canyon joined with high-ocean waves to undermine the Coast Highway at the canyon's mouth.











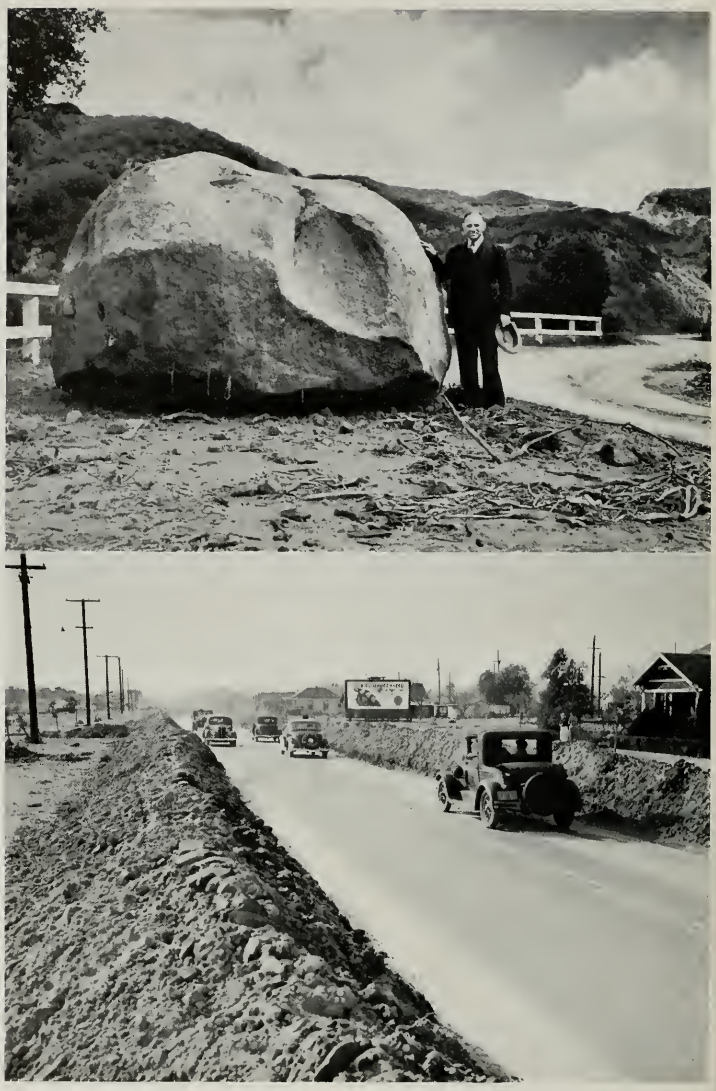
ing away portions of Routes 26 and 187, which lead to Palm Springs and the Coachella and Imperial valleys.

Farther east Whitewater River, after crossing Route 26, left its old channel, destroying a considerable section of the Southern Pacific's main line track to the east. Snow Creek, joined by the Whitewater River, washed out approaches to Snow Creek Bridge on Route 187, as well as long stretches of this highway between there and Palm Springs, virtually isolating the town.

In spite of the heavy damage, traffic was again moving over the greater number of these highways within a few days following the storm. It will require weeks, however, to restore many of those highways in the mountain areas to a safe traversable condition. In this district alone 215 trucks, 44 graders, 48 tractors, 29 power shovels and 1 pile driver, besides hundreds of men, were immediately placed on the restoration of the roads. Of this equipment, 122 of the trucks, 29 of the tractors, 7 of the graders, the power shovels and pile drivers had to be rented. Since competitive bids were required, it may readily be seen how effectively the district was organized.

In District VII

District VII, embracing Ventura, Los Angeles and Orange counties, received the first brunt of the storm as it came from the ocean, then its recoil as the floods rushed seaward back from the mountains. The San Juan, Santa Ana, San Gabriel and Santa Clara rivers covered the highways, destroying approaches, undermining the bridges, and in places carrying away large sections of roadbed. Here was a test for the district whose roads served half of the State's population and vehicles. That it was met, and in a remarkably short time, redounds to the District's credit. A brief resume of the extent of this problem now follows:

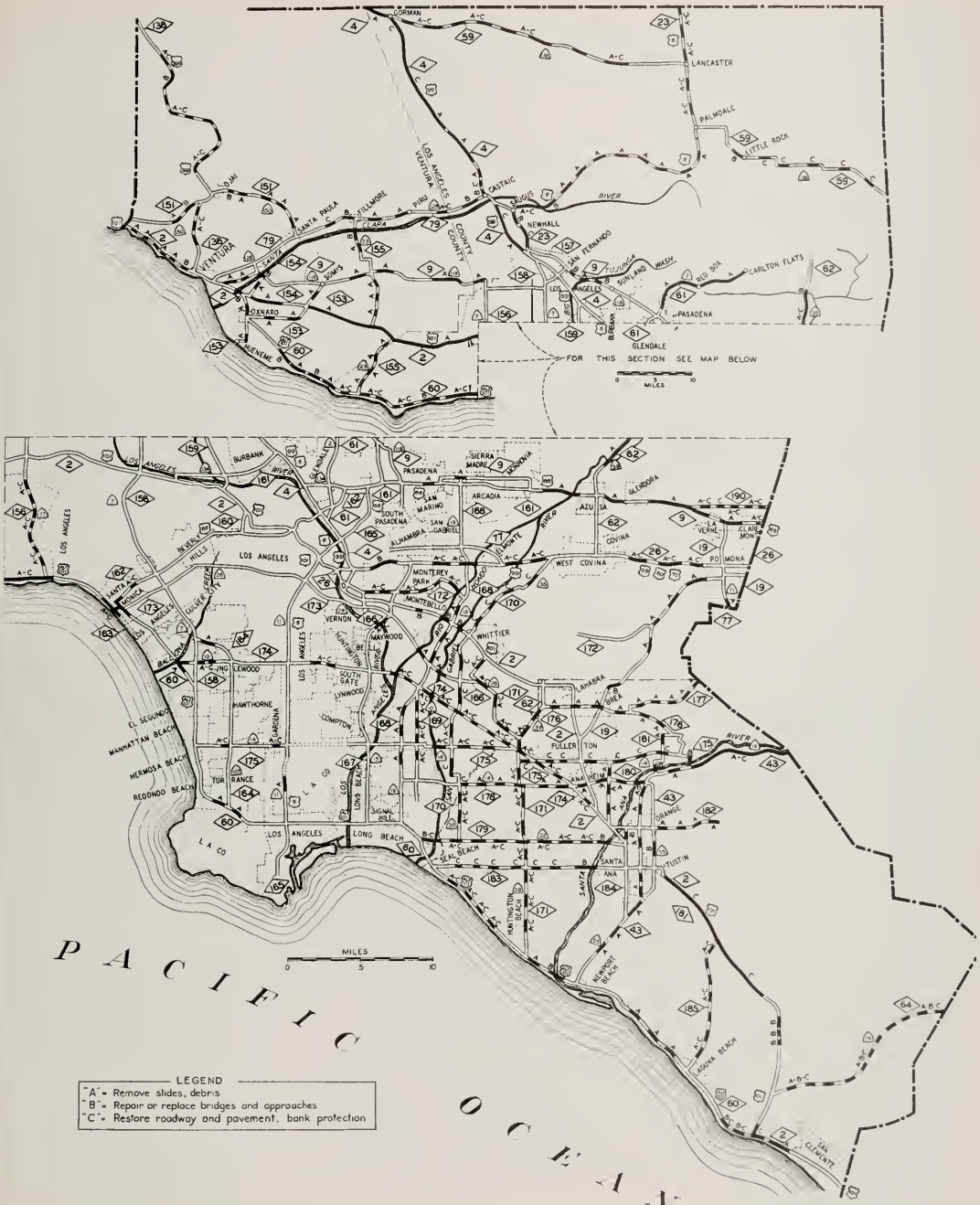


Upper—Huge boulder deposited by flood on Topanga Canyon Road below Wildwood, Los Angeles County. Lower—Mud cleared from highway near east city limits of Colton, San Bernardino County.

DESTRUCTIVE FLOOD WATERS

The Santa Ana River, fresh from its destruction of the Prado Bridge in District VIII, entered the canyon leading to Olive. On its way it washed out some 3000 feet of heavy roadbed construction and portions of three county-constructed bridges on State Routes 176, 175 and 181. Leaving the canyon, it spread wide over the highways and orchards, damaging everything in its path. Forced back to its channel south of Placentia, it again took its toll of the bridges. First and last on our highways were the Garden Grove structure on Route 179 and that north of Newport Beach on Route 60. At the former, it took out the westerly approach, making a new channel; and at the latter location it undermined piers, dropped four of the spans, and washed out some 2000 feet of the pavement.

This was the only State-constructed bridge lost on the Santa



Locations of State Highway damage in Los Angeles, Ventura and Orange counties marked by black blocks on roads. Legend explains necessary restoration work.

Ana, though no reflection is intended on those which failed when the river bed was churned to unknown depths by the turbulent flood. Within a week's time travel was again using the canyon, and pile trestles and detours have now closed the gap in the coast route.

SANTA CLARA RIVER CURBED

Once before the Santa Clara pushed its wall of water through the foothill towns of Piru, Fillmore and Santa Paula, leaving a trail of death in its wake. The Saint Francis Dam disaster taught its lesson, and though that former crest was equalled, the material loss this time can fortunately be repaired.

The Santa Clara, on its westward way, crosses Route 4—our Ridge Route—and parallels Route 79, crossing State Routes 155, 9 and 2 where it enters the ocean. On Route 4 it scoured the north approach to the highway structure, undermining the pavement. Proceeding westerly, it carried away 300 feet of the Bardsdale Bridge southerly of Fillmore on Route 155, and 500 feet of the structure on Route 9 at Saticoy.

Nearing the ocean, it swept wide of its banks covering orchards and farm lands and filling the El Rio Subway on Route 60 with sand and debris. East of Piru, on Route 79, its sharp swing into the bank carried away 3000 feet of the roadway.

BRIDGES RIPPED OUT

While this was taking place, its tributaries—Castaic and Sespe creeks—flowing from the north, carried away 200 feet of the bridge west of Castaic, and 800 feet of the Sespe's overflow structure west of Fillmore, effectively closing Route 79. The Sespe hurled the Southern Pacific structure, parallel and adjacent one on the highway, against the latter with such force that it left its moorings and has not been located since.

All of the structures mentioned as damaged were of early county construction and came into the State System under legislative act. Restoration work was immediately initiated, and traffic has now been restored on Routes 79 and 155, pile trestles and fills replacing the washed out structures and roads.

Early reports from the San Gabriel Mountains told of slide-blocked roads and embankments washed down the canyons on Route 62. Similar word was received from Route 138 high in the Santa Barbara National Forest. Here storm-swollen rivers preempted the canyons, carrying with them much of the roadway. Slides for a time blocked the Ridge Route, but men and equipment soon restored traffic.

The Coast Route 60 from Santa Monica west was covered with slides and debris from the various washes out of the Santa Monica Mountains. Topanga Canyon Route 156 was badly washed and immense slides closed the road to all through traffic. Malibu Bridge piers were undermined and several spans of the structure collapsed. Within a week's time, trestle bents carried the traffic, and power shovels and trucks were repairing the roadway.

Not one of the district's roads, east of a line between Long Beach and Pasadena, escaped damage. Day and night the district's forces labored, clearing debris-covered pavements, restoring protection work and supporting undermined pavements. Regular forces were augmented by some 700 men, 35 power shovels, 150 trucks, 3 pile drivers and other equipment. Within several days after the storm most of the main roads were open to traffic, though months will elapse before all are repaired.

In District XI

District XI, which includes the counties of San Diego, Riverside and Imperial, lay on the outer edge of the storm path. The damage here was less severe, though some 7.86 inches of rain fell near Descanso on March 3d within a 12-hour period. A 9-inch rain at Escondido forced a heavy runoff from Lake Hodges Dam into San Dieguito Creek, whose storm waters undermined the north approach to the San Dieguito Creek Bridge north of Del Mar on Route 2. Traffic was detoured five days while power shovels repaired the break.

The Puerta La Cruz Crossing on Route 78, and the dips at Pala and Pauma Wash on Route 195, were washed away, closing the roads for a period of three days. High water over Route 197 west of Ramona and on Route 198 north of El Cajon, forced the detouring of traffic for short periods.

In Riverside County, two timber trestles over the Coachella Valley Storm Drain on Route 187 were destroyed by high water. These were obsolete structures, taken into the State System by legislative act, and



This is how flood left E Street in San Bernardino, a thoroughfare leading to famous Orange Show Pavilion, which can be seen on the left of power shovel removing five feet of mud.

plans were already under way for their replacement.

In District V

District V, embracing Santa Barbara, San Luis Obispo and Monterey counties, was even more fortunate than District XI, as the storm closed but few of its major highways.

Eleven inches of rain on the San Marcos Pass, State Route 80, during the storm period, caused numerous slides on the east slope, as well as damage to the approaches of Santa Aqueda Creek Bridge. Detours were available and traffic was therefore put to no great inconvenience.

The heavy downpour, however, added many thousands of yards of slides on the Carmel-San Simeon road, State Route 56; the Mustang Grade, State Route 10; and the Pinnacles Road, State Route 119. Eight power shovels and thirty-five trucks are now engaged in clearing these roads.

Truck traffic was held up for a few hours when the Santa Maria River swept over the ground level road in the old overflow channel, forcing light traffic to use the old trestle. The heaviest damage occurred on the Cuyama Road, State Route 58, where a section of pile trestle was carried away by the flood.



Overflow waters from Coyote Creek left Firestone Boulevard, Los Angeles, looking like this after being cleared of silt.



This picture vividly reveals damage wrought by Santa Clara River floods on Ventura-Castaic lateral highway between Piru and Los Angeles County line in Ventura County.

(Continued on page 24)

DAMAGE TO BRIDGES HEAVY

By W. A. DOUGLASS, Associate Bridge Engineer

IN DECEMBER 1937, a series of severe storms swept over Northern and Central California, breaking records for concentrated rainfall and leaving widespread damage both to private and public property. Direct and immediate losses to State highway bridges alone exceeded a half million dollars, and the total cost of repairs and replacement on State highways is estimated at nearly three million.

In turn, Southern California was visited, during the first week of March, 1938, by storms leaving behind property damage many times that of the December storm in the north.

The areas most seriously affected were in Los Angeles, Orange, San Bernardino and portions of Ventura and Riverside counties. Effects of the storm, to a lesser extent, were also felt as far north as Monterey and Fresno counties. Rough preliminary estimates indicate a direct loss of State highway bridges in the March storm of over one and one-half million dollars. The total loss to State highways during this storm has been estimated at over five million dollars.

STREAM CONTROL STUDIES

In addition to the restoration of highways and structures, there will be the cost of new waterway openings and extensive protection work, the need for which became apparent during the recent storm. Extensive studies of the entire area together with the past and probable future behavior of the streams, planned and probable stream control work by other agencies and property owners and a number of other factors must be made before the entire cost may be calculated. The cost of additional bridges, bridge extensions, slope protection and stream control in the immediate vicinity of highway crossings may easily cost a million dollars in addition to the restoration of facilities destroyed by the flood.

The following data will give an idea of the extent and character of the flood damage to State highway structures. Reports indicate that about forty-five bridges were totally destroyed or seriously damaged. Approach fills were washed out in a number of cases and in three or four locations it appears that extensions to the bridges will be necessary. In at least ten locations entirely new channels were cut across the highway and, in each case it will be necessary either to provide new bridges or return the streams to their former locations.

BRIDGES WIPED OUT

In western Fresno County, Waltham Creek carried a considerable flow. State Route 10 follows this stream closely, westerly from Coalinga, and a number of temporary crossings as well as a county built concrete bridge were damaged.

A timber bridge over the Cuyama River was washed out near the Santa Barbara-San Luis Obispo county line east of Santa Maria.

The Santa Clara River flooded taking out portions of two bridges, one crossing the river near Fillmore and the other near Saticoy. These were both old structures on sections of highway recently taken into the system. It is interesting to note that both these bridges withstood the flood caused by the failure of the San Francisquito Dam in 1927, when a portion of the bridge on the coast highway was destroyed. The latter has since been replaced with a modern structure which was not damaged in the March flood while the two older bridges upstream were seriously damaged.

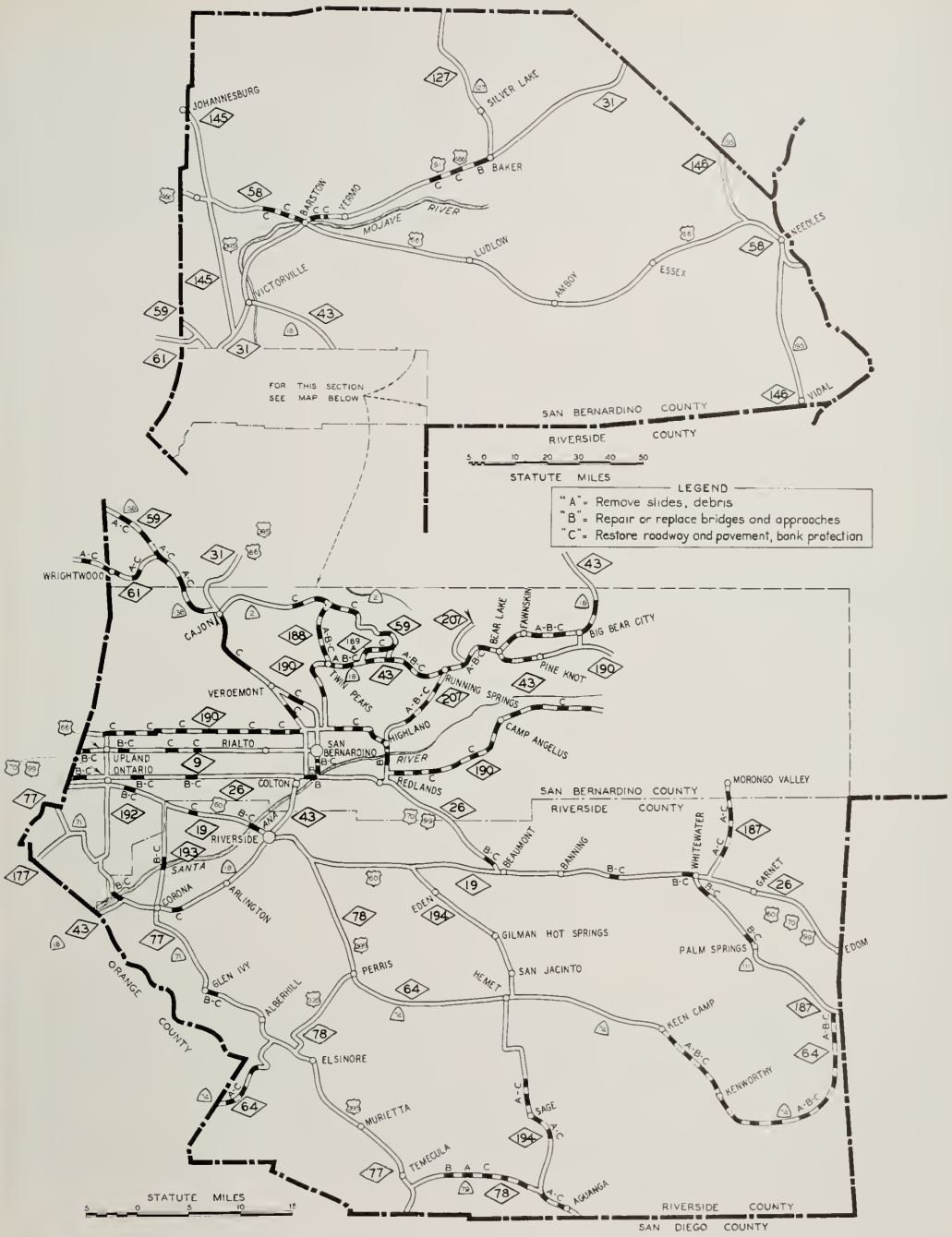
SANTA CLARA RIVER RAMPAGES

In the valley of the Santa Clara River Highway Route 79 was washed out in spots and two bridges were damaged. An old timber structure over the Sespe Creek Overflow at the westerly edge of Fillmore is practically a total loss. Although it is planned to construct a line change and eventually abandon this particular section of road as a State highway, a bridge will be necessary to accommodate through traffic for about one year and it will continue in use permanently for local traffic.

Three spans of another old timber



Bridge under construction across Big Creek on the San Simeon-Carmel coast highway in Monterey County. Concrete piers withstood flood waters but high winds blew down falsework of one arch.



State Highway damage in San Bernardino and Riverside counties marked by black blocks on roads. Legend explains necessary restoration work.

bridge over Castaic Creek just west of the junction of Route 79 with Route 4 were taken out by the high water. This bridge will probably be replaced with a modern type bridge at a slightly higher grade.

SPANS DESTROYED

Three spans of the concrete bridge across Malibu Lagoon, on the Coast Highway above Santa Monica, were lost when heavy scour caused settlement of two piers. This bridge was built by the county about 1923 and later widened to a forty foot roadway by the State.

Further south on the same route, the reinforced concrete bridge near the mouth of the Santa Ana River was damaged in a similar manner. The overflow from this river also washed out a short section of fill a few hundred feet north of the bridge.

Near the junction of Route 60 with Route 2 at Serra, San Juan Creek crosses State Routes 64, 2 and 60. One steel stringer span of a timber and steel bridge on Route 64 was lost. On Route 2 a comparatively new concrete bridge was not injured except that scouring of approach fills resulted in some loss of slope pavement. On Route 60 no damage occurred to the new concrete bridge but additional length of bridge may be advisable to permit more immediate run-off.

Of some fourteen State highway crossings of the Santa Ana River only four are of modern steel or concrete design and of these four, only one, built about 1925, was damaged. The balance of the Santa Ana bridges were built prior to the inclusion of the routes in the State system. Of the latter group, five bridges were lost or seriously damaged.

In the vicinity of San Bernardino and westerly toward Upland and Pomona, many streams such as the Santa Ana River, Warm Creek, Lytle Creek, Cucamonga Wash and San Antonio Creek, overflowed their banks and in several places established new channels across the highways. Damage by these streams occurred particularly on Routes 9, 26 and 19. New structures, bridge and culvert extensions and extensive protection and control work will be necessary to avoid a repetition of the losses.

It will be noted that this area lies adjacent to the foothills of the San Bernardino Mountains. The sparse forest cover of the mountains permits rapid run-off of rain falling on them with resultant flash floods and high velocities in the canyons. All these conditions are conducive to heavy scour on the steep slopes and the silt and debris is carried to the valleys and plains at the foot of hills where the flatter gradients of the streams permit silting. These silt deposits form debris cones which in this section have built up over a long period of time to sizable proportions and cover areas of many square miles.

The streams ordinarily follow a course somewhere near the center of the cones and the banks of the channels are usually somewhat higher than the adjacent slopes of the cones. As a result of this condition, the streams at flood stages overflow the banks and spread out over the flat slopes of the cones readily forming new channels in the relatively loose and unstable silt deposit.

DEBRIS CONES

Boulders, drift or other obstructions particularly near the upper ends of the cones may easily deflect the flow to one side or the other and change the entire course of the streams. It was these changing conditions and locations of streams which caused so much damage to east and west highway Routes 9, 26 and 19 which cross several such debris cones between Pomona and San Bernardino.

A similar condition occurred in the Big Tujunga Wash. Route 9 crosses this stream between Pasadena and San Fernando. Bridges were provided for both the north and south channels, both of which seemed to be well defined. However, during the March storm, overflow from the south channel spread out and caused considerable damage to the highway between the bridges. The bridges were not seriously damaged but approach fills and protection work were partially destroyed.

Due largely to the heavy flow in the Tujunga, the Los Angeles River



Sespe Creek swollen out of its banks by tributaries in a high mountain area of Ventura County cut a wide swath of damage as it swept across State Highway 79 near Fillmore. A county-built timber and concrete bridge and a paralleling railroad structure were washed away. A large section of highway was obliterated but a detour road shown at right was quickly built and opened.



Before and after views of the bridge across Verdugo Creek on State Highway 61 in Los Angeles County. Fed by small tributary streams in the San Gabriel Mountains the creek became a raging torrent that cut a new channel, swept away the bridge approach and damaged the abutment.

carried an unusually large run-off. The bridge built by the city over that river on Lankershim Boulevard (Highway Route 159) was lost.

In addition to the Los Angeles-San Bernardino and coastal plain area, floods occurred on the Mojave River, damaging the highways near Barstow, probably necessitating a bridge over at least one new channel and taking out bridges at Cronise Valley and Baker. The Owl Wash and San Gorgonio Wash east of Banning on Route 26 established new channels which will require bridges and protection work. The Whitewater River at two crossings of Highway Route 187 between Indio and Mecca took out portions of two old timber bridges, one of which was included for replacement in the budget for the present biennium. Smaller bridges were lost also on the "Pines to Palms Road" east of Hemet and on various routes in the San Bernardino Mountains.

A number of the bridges damaged during the flood are located on Federal Aid Routes and are considered qualified for Federal Emergency Relief funds. The balance of the cost will be financed from State Highway Construction and Maintenance Funds.

STREAMS TEAR OUT HIGHWAYS IN DISTRICT XI

By E. E. WALLACE, District Engineer

The severe rain storm which hit Southern California between February 26 and March 5 did heavy damage to some of the State highways in portions of District XI, which encompasses San Diego, Imperial and the east half of Riverside counties.

On State Route 2, U. S. Highway 101, between San Diego and the northerly county line, there were several incipient failures of bridge approaches due to slumping and erosion of approaches and pot holing around the bridge piers. Protective measures prevented serious damage or interruption to traffic except at the San Dieguito River Bridge, just north of Del Mar, where 40 feet of the north approach fill slumped out under the footing of the north abutment and between the pilings, due to severe scouring action in front of the abutment.

SLIDES AND WASHOUTS

On Route 78, at the Puerta La Cruz crossing of the San Luis Rey River north of Warners Hot Springs, the central 100 feet of an overflow dip washed out. The dip carried water up to a depth of about five feet, but failed when a peak of more than six feet occurred. Traffic was restored by the construction of a temporary fill after the water subsided sufficiently, three days later.

On Route 195, between Bonsall and Morettis, there were numerous slides and washes, particularly on Cuca Grade, where severe shoulder erosion occurred. At the Pala Dip and Pauma Wash, the shoulders were

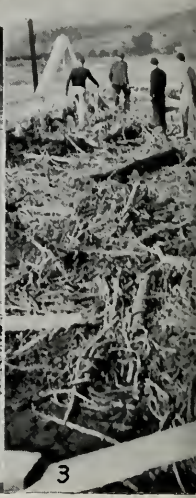
(Continued on page 22)



Highway dip washed out by Santa Maria River east of Ramona. Another dip west of Ramona overflowed.









BRIDGES HARD

1—San Antonio Creek Bridge

2—Santa Clara River Bridge

3—Wreckage of bridge across

4—Santa Ana River Bridge e

5—Sespe Creek Bridge east o

6—Big Tujunga Bridge, Los

7—Cujama Bridge, 20 miles e

8—Santa Clara River Bridge,

9—Bridge across Santa Ana

10—Bridge across Santa Ana

11—Santa Ana River Bridge in

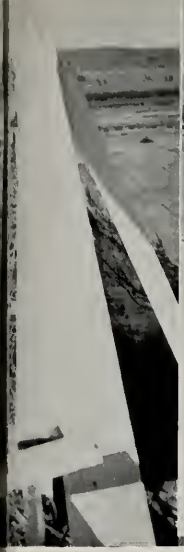
12—Castaic Creek Bridge, Los

13—Santa Ana River Bridge n











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IT BY FLOODS

ra County.

Elmore.

Ana River, Orange County.

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Santa Ana Canyon.

Ana Canyon.

County.

, Orange County.



8



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Snow Removal to Date Totals 100,000,000 Cubic Yards

By W. A. SMITH, Assistant Maintenance Engineer

THE 1937-38 winter season in northern California started in a normal manner with the first snowfall on October 3. The first real storm extended from November 11 to 18.

Typical of the storm periods and the rate of snowfall is the record obtained by District III from the United States Weather Bureau station located three miles west of Donner Summit at Soda Springs on U. S. 40.

Storm Periods 1937	Snowfall During Storm in Inches	Depth of Snow Pack in Inches
October 3	3	---
November 11 to 18	53	31
December 10 to 11	(10.8 inches rainfall)	---
December 22 to 25	24	28
1938		
January 15 to 20	48	53
January 31 to February 15	256	202
March 1 to 3	31	138
March 15 to 23	63	170

The total snowfall at Norden near the Donner Summit as reported to date of April 1 was 587 inches.

IN OTHER AREAS

The record of snowfall on a few other routes, typical of various areas is as follows:

	Inches
Sign Route 24—East of Quincy	208
U.S. 99—Vicinity of Weed	132
Sign Route 89—Cayton Valley	207
U.S. 299—Fall River	195
U.S. 97—Weed to State line	207
Sign Route 36—Deer Creek Meadows to Susanville	507
Sign Route 36—Paynes Creek to Deer Creek Meadows	551
Sign Route 8—At Antelope Springs east of Jackson	106
Sign Route 4—At Camp Connell east of Big Trees	216
Sign Route 108—At Pinecrest east of Sonora	261

The last three points are at the limit of winter maintenance.

The Redding district estimates that some forty million cubic yards of snow was moved by their forces. On the same basis for the other districts, in excess of one hundred million cubic yards of snow has been removed from the highways during the season.

Snow Removal Crews Lauded

Tahoe, California
Feb. 23, 1938

Mr. C. H. Weeks,
Division of Highways,
Truckee, Calif.

Dear Mr. Weeks:

We do want you to know how very much we appreciate the untiring efforts of yourself and your crew in getting the road open to Tahoe, and feel that this is the sentiment of all in this region. During a storm, many people become panicky, and perhaps you were unduly harassed, but we know that you did all that was humanly possible.

We hope the time will come, and before too long, when a plow can be kept for use in the Lake Tahoe region. The railroad parallels the road over the summit, and can be used in emergency, while we are dependent upon the road being kept open between Truckee and Tahoe. We who have lived here for many years have an emergency supply, but many people nowadays just live from one day to the next, and think they are suffering unless they can have everything a city market affords.

We would like to write a letter, commending the efforts of yourself and your crew, to the higher-ups. To whom should it be addressed to do the most good?

Yours very truly,

(Signed)

Mr. and Mrs. George R. Bliss

156 PLOWS PROVIDED

In preparation for the work, the Division had purchased nine auger type rotary plows, making a total of twenty-six plows of this type ready for service. In addition to the rotary plows, some one hundred and thirty push plows of various types were made ready for service.

In order to reduce drifting in certain well defined areas, eleven miles of new snow fence was erected, and the fence erected in previous years was repaired or reinstalled at locations where it had been taken down at the end of the 1936-37 winter season.

When the season advanced toward the end of January, the department began to feel that this was to be one of those exceptional years. Certain roads, such as U. S. 50 over Echo Summit and many miles of other mountain routes, were still open to travel, a condition that had not existed in any season since snow removal was undertaken.

MANY FALLEN TREES

With the start of the storm on January 31, however, this optimism was quickly dispelled. The snow was heavy but still drifted badly. In certain areas the snow removal was seriously handicapped by the large number of trees that fell into the traveled way. At such times the plows were tied up until a path could be cut and in the meantime the road was becoming filled with drift.

The normal plan in snow removal work in the heavy fall areas is to start the push plows as soon as there is enough snow on the pavement to form a windrow. The rotaries then come along and move this windrow clear of the roadway. Under the conditions encountered, the crews found

(Continued on page 22)









Snow removal crews and equipment. Upper—Maintenance Station Building and crew at Yuba Pass on Donner Summit Highway. Center left and right—Snow plows operating day and night on Donner Summit. Lower—Interior of Donner Summit Maintenance Station showing men and equipment.

El Camino Real Project In San Diego Dedicated by Governor

AS THE setting sun cast a roseate glow over the waters of the Pacific on the evening of Saturday, March 26, Governor Frank F. Merriam stood on the Coast Highway at the San Diego County line north of Oceanside and formally opened and dedicated the $1,225,000 final link of a multi-lane highway extending for 235 miles from the Mexican border to Santa Barbara on U. S. Route 101.

The ceremonial climaxed a day of fiesta celebration under auspices of the Oceanside and San Clemente chambers of commerce that began with a large official luncheon at the California-Carlsbad Hotel in Carlsbad, which was followed by a radio dramatization of the Romance of El Camino Real at Oceanside Beach stadium and concluded with a coronation ball at San Clemente Casino where Miss Norma Ellis, of Oceanside, queen of San Diego County highways, and Miss Dorothy Walker of San Clemente, queen of Orange



Governor Merriam and Leo Carrillo.

County highways, reigned over the festivities.

In his brief dedication address Governor Merriam said the latest ideas in modern road building had been incorporated in the newly completed 18-mile stretch between San Onofre and Oceanside. The State Highway engineers, he pointed out, had provided two and one-half miles of four-lane divided highway with ample division strips arranged to separate opposing streams of traffic and make headon collisions virtually impossible.

Governor Merriam told of the efforts of the early road boosters and builders, of the $73,000,000 successive bond issues that were expected "to build all the roads California would ever need" and the progress that began and has continued under the gas tax.

"Under the gasoline tax we have been moving fast," he said, "building better, stronger, wider highways and incorporating more safety features, but this is not the end. There are greater things ahead, greater developments for the men and women and youth of California both materially and spiritually."

WEDDING OF COUNTIES

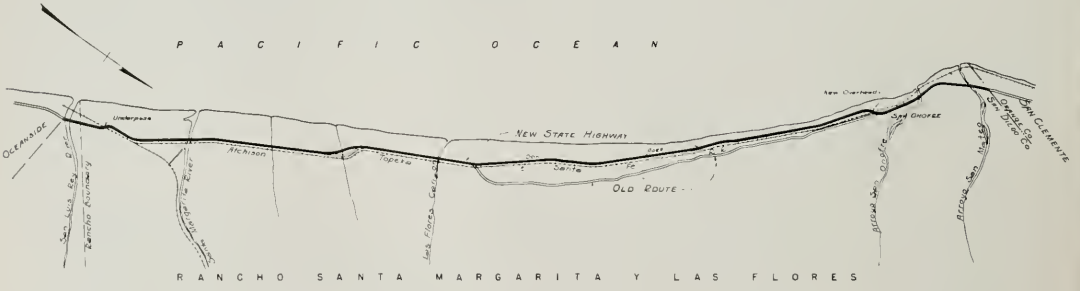
Other speakers were State Highway Commissioners William T. Hart and Phillip A. Stanton, Hamilton Cotton, Mayor Albert P. Waibel of Oceanside and Mayor Dan Mulherron of San Clemente. General Chairman E. E. Hyde announced that the theme of the occasion was the "wedding" of Orange and San Diego counties and called upon Assistant Director of Public Works Harry A. Hopkins to perform the nuptial ceremonies.

On the San Diego County side of the boundary line were Mayor Waibel; Supervisor B. A. Sweet; Commissioner Hart, representing the State, and Queen Norma Ellis. On the Orange County side were Mayor Mulherron; Hamilton Cotton, substituting for a county supervisor, Commissioner Stanton and Queen Dorothy Walker.

Assistant Director Hopkins paraphrased a wedding service with the others joining hands and responding "I do" to the "marital" obligations.

CARLSBAD LUNCHEON

Governor Merriam then tied the white ribbons together symbolical of the "wedding" of the counties, and dedicated the new highway "to the use, pleasure and convenience of the people of the counties, the State, the Nation and visitors who come to





The ample separation strip on the four-lane section of new realignment between San Onofre and Oceanside renders head-on collisions practically impossible.

California from nearly all countries in the world."

The official luncheon at Carlsbad was attended by several hundred citizens, city, county and State officials, contractors and chamber of commerce representatives. Leo Carrillo, motion picture star, was master of ceremonies and the "kidding" and sallies of wit and repartee that passed between him and the Governor added much merriment to the occasion.

In his speech Governor Merriam told of the efforts of farsighted men and women of San Diego and Los Angeles who late in the last century talked and dreamed about a highway that would follow the trail of the Franciscan friars all the way north to Sonoma.

Reviewing the difficulties that had to be surmounted through the period of the inadequate bond issues to the coming of the gas tax financing plan and the progress that has been made since then Governor Merriam said:

"As you know, our highways are built and maintained by gasoline and motor vehicle tax funds. Without the gasoline tax we could not have our vast highway system and without it we could not be dedicating this completed road today. Our gasoline tax moneys must never be diverted to purposes other than highway construction.

"You can safeguard these funds for all time by a constitutional provision making their misuse impossible. You will have an opportunity to do this at the general election in November."

State Director of Public Works Earl Lee Kelly told the assemblage that the people were to be congratulated in having a Governor who cooperated so zealously in keeping the gas tax funds for roads.

"Since Governor Merriam has been in office more money has been spent on the development of this road than in any other period. It has been developed from a 15-foot road to a highway with three and four 12-foot lanes. The contention that the gas tax fund is so large that a portion of it can be used for other purposes is erroneous. Our traffic has increased from 77,000 vehicles to more than 2,500,000 automobiles, outranking every other State in the Nation. We are now ten years behind in our highway construction program necessary to satisfy present traffic needs."

State Highway Commissioner Hart introduced other dignitaries present and brief talks were made by Assistant Director Hopkins, Commissioner



View of four-lane divided highway section on new realignment of Coast Route (U. S. 101) between Oceanside and San Onofre.



"Wedding of the Counties" was the symbolic theme of the ribbon ceremony at the dedication of the newly completed Oceanside-San Onofre link of Coast Highway as Governor Merriam tied the ribbon joining San Diego and Orange Counties. At left, Mayor A. P. Waibel of Oceanside, State Highway Commissioner W. T. Hart, Supervisor B. A. Sweet and Queen Norma Ellis representing San Diego County. At right, Queen Dorothy Walker and Highway Commissioner P. A. Stanton, representing Orange County.

Stanton, District Engineer E. E. Wallace and H. Matthias, representing the contractors.

Some 3000 people attended the El Camino Real dramatization based on historical facts and incidents that followed the luncheon in which Governor Merriam, Mr. Kelly and Leo Carrillo participated.

CONTRACTS COVERED 18.5 MILES

The progressive improvement in San Diego County to the main State highway connecting San Diego and Los Angeles has been one of the larger programs of the Division of Highways for modernization of arterial routes in Southern California. As important units in such reconstruction several contracts involving work on the 18.5 miles between Oceanside and the Orange County line through the great Santa Margarita Ranch in northern San Diego County have been completed at a total cost of approximately $1,225,000.

These contracts included improvement to modern standards of alignment and grade with multiple lane pavements providing better facilities for movement of the ever increasing volume of traffic on this important State route. In the last year or two travel along this portion of El Camino Real reached a volume for which two lanes were inadequate, the daily average ranging from 6,500 to 8,500 vehicles, with many days totaling 10,000 and more cars. In design of the improvements, an ultimate 4-lane divided pavement was adopted as the desired standard and both reconstruction and new construction adapted to fit into such a plan.

WIDENED TO 3-LANE

The first of the contracts for the present improvement to the highway north of Oceanside covered a distance of 7.9 miles, from Eighth Street in Oceanside to the Las Flores Underpass. The work performed under this contract consisted in widening the pavement to provide a 3-lane highway on existing alignment for the southerly 5.4 miles and constructing new 2-lane pavement to serve for southbound traffic only, thus providing a 4-lane divided highway over the remaining portion. The existing pavement, separated from the new pavement was left intact to serve for northbound travel.

The contract also included paving the approaches to the bridge across Santa Margarita River, which was built under a separate contract concurrently with the road reconstruction; the construction of a bridge across Aliso Creek; and the widening of the bridge across Las Flores Creek. The bridges and their approaches were constructed to 4-lane widths to conform to plans for ultimate standards.

ULTIMATE 4-LANE PLAN

Widening the pavement to three lanes was accomplished by placing a lane of asphalt concrete along one side of the existing Portland cement concrete pavement. Under this method, the plan for future widening will be to place two additional concrete lanes beyond the asphalt so that a divided 4-lane roadway may be obtained by tearing up the center strip of asphalt.

Work on the contracts for the portion of the route from Oceanside to the Las Flores subway was performed by the contracting firm of Wood and Bevanda of Stockton, with the exception of the bridge across the Santa Margarita River, which was erected by Clyde C. Wood, and the approach

fills constructed by Basich Brothers. The largest contract in the improvement north of Oceanside consisted of construction on new alignment of 8.0 miles from the Las Flores underpass to one mile south of San Onofre. On this portion of the route the new highway was placed parallel to and westerly of the tracks of The Atchison, Topeka and Santa Fe Railway, instead of passing under the railroad through the Las Flores Subway on the old alignment and following the base of the hills easterly of the tracks. At the time this revision in highway line was planned, a realignment of a portion of the railroad's line was undertaken to the benefit of both the State and the railway location.

The pavement placed on the new location consisted for the most part of a 3-lane width made of a central lane of plant-mixed asphaltic surface with a lane of Portland cement concrete on each side. Future widening of this section will require only the placing of one additional concrete lane on each edge of the present three lanes which, with the breaking up of the central lane of treated rock surfacing, will provide a 4-lane divided highway.

OLD ROAD ELIMINATED

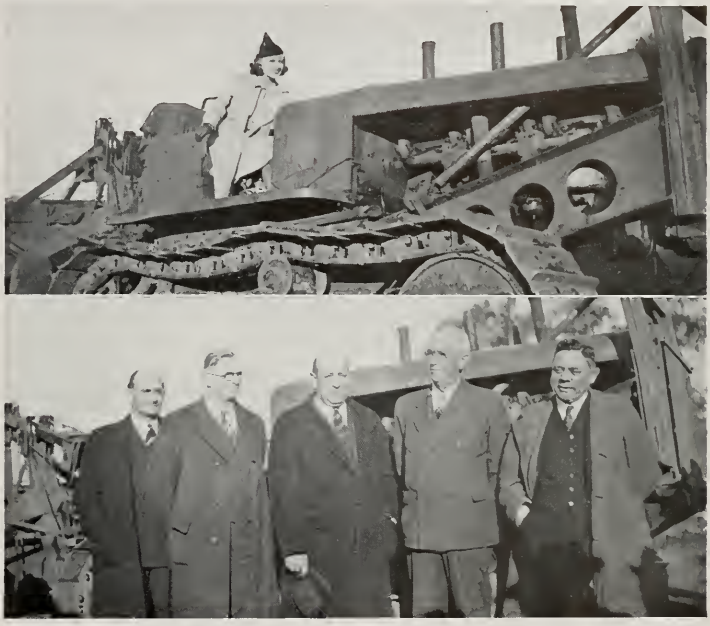
The construction of this eight mile section on new location has eliminated from the State route the substandard portion of the old road which was built at the foot of the hills on a rolling grade.

David H. Ryan was the contractor on this important contract.

At the San Onofre end of the new location the State constructed an overhead grade crossing over the railroad to connect with the existing 3-lane pavement near San Mateo Creek. To effect this location a new bridge across San Onofre Creek was required. Both of these structures were built to a 4-lane standard but the roadway improvement was held to a 3-lane standard on the 2.6 miles from the overhead crossing to the county line, with the exception of necessary transitions at structure approaches.

There were three contracts for construction at this northerly end of the improvement: one for the overhead crossing, one for the bridge over San Onofre Creek and one for the road work. B. G. Carroll of San Diego was the contractor to whom each of these contracts were awarded.

CEREMONIES LAUNCH WORK ON ARROYO SECO HIGHWAY



Scenes at groundbreaking on Arroyo Seco Highway. Upper—Miss Cheryl Walker moves first earth with huge tractor. Lower—Left to right: John C. Jacobs, mayor of South Pasadena; Arthur Kennedy, president Los Angeles City Planning Commission; Roger W. Jessup, chairman Los Angeles Board of Supervisors; E. O. Nay, president Board of City Commissioners, Pasadena; Harry A. Hopkins, Assistant State Director of Public Works.

HOPES and plans of civic leaders of Los Angeles, Pasadena and South Pasadena, sustained and carried to fruition over a period of twenty years, were realized on March 22 when ground breaking ceremonies signalizing the start of work on the $1,327.000 Arroyo Seco Parkway between Los Angeles and Pasadena were held at South Arroyo Boulevard and Sterling Street in South Pasadena.

State and county officials participated in the celebration. Ground breaking ceremonies included brief addresses by Edward S. Graham, President of the Arroyo Seco Parkway Association, who presided; Carl Hinshaw, chairman of the executive committee of the association; Harry A. Hopkins, Assistant State Director of Public Works; Roger Jessup, chairman of the Los Angeles board of supervisors; A. W. Kennedy, Los Angeles city planning commission; Mayor John C. Jacobs, of South Pasadena; and E. O. Nay, chairman of the board of trustees of the city of Pasadena. Among others on the speakers platform were William J. Fox, county regional engineer, and S. V. Cortelyou, District Highway Engineer.

Actual breaking of ground on the project became a reality when Miss Cheryl Walker, Queen of the 1938 Tournament of Roses, pulled the lever on a giant tractor which moved the first earth on the roadway site.

Following the ceremonies, a breakfast was served at the Pasadena Athletic Club, presided over by Donald C. McCoy, vice president of the Pasadena Chamber and Civic Association.

(Continued on page 27)

Snow Removal Totals 100,000,000 Yards

(Continued from page 16)

that the push plows shortly were of little use.

On February 8, rain fell up to the 6,000 foot elevation, and the packed snow on the pavement turned to heavy slush, making it necessary to concentrate the equipment to combat this condition, as traffic and even the snow removal equipment could make little headway in such going. As the storm continued the rotary equipment began to show the strain, as it was operated continuously except for servicing periods, and breakdowns began to occur.

HANDICAPPED BY BREAKDOWNS

Naturally this further complicated the situation, as breakdowns occur in the heaviest going. This requires moving equipment from another section where it is badly needed, in order to rescue the cripple. In locations where normally one plow only is required, a breakdown for a few hours allows the road to close and may more than double the work of opening the road.

The comparatively high temperatures with occasional rain in the upper elevations caused the snow to pack solidly, although there was little ice next the pavement. Opening the roads, such as the Tahoe-Ukiah route between the Washington Road and junction with U.S. 40, and between Truckee and Tahoe City, was unusually difficult.

In the latter case, twelve hours of continuous operation was necessary to open a section three hundred feet long at Deer Park, where a snow slide had occurred.

COST OVER MILLION

The snow removal work for the 1937-38 season will not be completed for some time, as considerable fall may be expected during April, and opening the closed routes will probably extend well into June in a few cases.

Under the existing program all established communities are provided an outlet, although the more remote places may be snowbound for the duration of a severe storm and even the main roads closed to part or all traffic because of the hazard. In view of the need of funds for other purposes and the fact that six cents of every dollar provided for maintenance purposes during the past two years has been expended for snow removal, it seems wise and reasonable to delay expansion of the program into strictly recreational areas.

The hazards may be poor visibility, narrowed roadway, snow slides and blockading of the road catching some unwary traveler in an isolated position. It is to the credit of the field organization that no serious mishap has been recorded this season, although a number of travelers have been blockaded for several hours at different times.

Mr. C. H. Weeks,
Division of Highways,
Truckee, Calif.

Dear Mr. Weeks:

Perhaps the worst of your work is over for a bit so you can take a moment off to read a few words of commendation I should like to say for the splendid work of your maintenance crews on Highway 40 which you control.

On the night of February 2-3, I had the tremendously interesting experience of spending some 12 hours in the Yuba Pass district, most of it with three of your young snow plow drivers. A broken skid chain stalled me just past Emigrant Gap, and after sending Mrs. Howard and children to Baxters, I stayed with the car. Darn near frozen and blinded in the storm, I was rescued by Driver Wallace and passed on successively to Peters and Lowry. Riding with them I had firsthand opportunity to judge of the work they are called upon to do and to note the skill, the loyalty, and untiring energy they put into their tasks. I won't forget that night. Through the courtesy of these men and of Mr. Hawks, I escaped pneumonia, had my chain fixed, and finally got on my way. Was stalled by other vehicles next morning but hauled out by the Snogo and reached Baxters after lunch on the 3rd.

I'd like to say a word for Wallace, Peters, and Lowry, particularly the former. Men who work 15 hours as cheerfully and competently as these men show that their superiors are the right sort. You have their respect and you have built up a fine organization.

Sincerely yours,

(Signed) I. C. HOWARD

Berkeley, Calif.

District XI Damage

(Continued from page 13)

washed out due to the high water, and traffic was halted three days until the waters subsided.

On Route 197, west of Ramona, a concrete overflow dip with paved slopes across the Santa Maria River was badly undermined, leaving only the dip shell remaining.

On Route 198, north of El Cajon, the San Vicente Creek overflowed the road, washing out shoulders and short pieces of pavement.

On Mussey Grade, a frame house floated downstream and blocked a 10 by 10 foot culvert, causing a 25-foot section of fill to wash out. Two miles east of Ramona, 80 feet of a concrete overflow dip across the Santa Maria River was washed out.

In Riverside County, two timber trestles across the Coachella Valley Storm Drain were washed out on Route 187. The drain also broke at one place north of Route 204 and the flood waters passed over Routes 203 and 204, depositing thick layers of mud and debris on the pavement and washed shoulders.

In all cases where traffic was interrupted, it was restored either by temporary repairs or by detours over adjacent roads within three days after the damage occurred, and in all cases except two, within a few hours.

Bay Bridge Is Provided With Air Analyzer

SACRAMENTO laboratories of the Division of Highways have devised an air analyzer for use on the San Francisco-Oakland Bay Bridge, the first ever used on a bridge, it is believed.

The instrument has been placed at the crux of the giant steel cross-beams just below the lower deck at Tower W-2. It works like this: a four-blade scoop-like fan operates a pump which sucks the air into a bottle of distilled water. Thirty revolutions of the fan make one revolution of the pump, scooping up 75 cubic centimeters of air. When the counter on the pump shows up to 99,999 revolutions, the bottle is removed, sealed, and sent to the Division of Highways' laboratories in Sacramento for analysis; 7,500,000 cc. of air can be drawn through the apparatus with accuracy.

First experimental tests, according to Carl Hamilton, Maintenance Engineer of the Bay Bridge, show that the big span breathes an atmosphere consisting, among other things, of sulphates, salt, coffee chaff, and soot.



This instrument is an "air analyzer" used on the San Francisco-Oakland Bay Bridge. Carl Hamilton, Maintenance Engineer of the span, demonstrates its use.

Object of the apparatus is to analyze the air for components destructive to paint.

The air analyzer is being used in conjunction with "washing" tests. So far 120 "spots" on the bridge, of 2½-square feet proportions, have been "washed" by clean cheese cloth dipped in distilled water. The cloth is wrung dry after the process into a bottle and the water sent to Sacramento laboratories for analysis. From 9 ounces of distilled water approximately 8 ounces are recovered after the washing, according to Mr. Hamilton.

Railway Facilities on Bay Span Nearing Completion

With practically all ties laid east of the Center Anchorage and rails placed east of Pier E-6, work on the construction of electric railway facilities for the San Francisco-Oakland Bay Bridge is progressing rapidly, it is announced by Chief Engineer C. H. Purcell.

Approximately 105,000 California Redwood ties, equivalent to 7,000,000 board feet, will be used on the railway facilities and 15,910,000 gross pounds of track rail. On the bridge proper and the viaduct connecting with the Terminal Building 400,000 spikes will be used, approximating a weight of 320,000 pounds.

He: "I'm almost fast asleep."
She: "That's good, because you're plenty slow when awake."

Bay Bridge Traffic Up Slightly

A SLIGHT increase in traffic over February was announced by State Highway Engineer C. H. Purcell in a March report on the San Francisco-Oakland Bay Bridge filed with State Director of Public Works Earl Lee Kelly.

There was a total of 669,431 vehicles crossing the span last month compared to 594,378 in the preceding period. Daily average was 21,595, up 367 vehicles per day over February. Total vehicles using the bridge to date number 12,380,000.

Three additional days in March over February accounted in part for the increase, Mr. Purcell said, with seventeen rainy days recorded last month.

March traffic totals, however, showed a decrease by 96,884 vehicles from the corresponding period last year. An optimistic note was the increase in freight using the span in March. There were 68,607,331 freight pounds recorded, the largest total since the span opened, except for October, when there were 69,243,169 pounds. The March revenues were $348,235.23 as compared with $313,306.17 for February. Comparative totals follow:

	Total March	Total Feb.	Total since Opening
Passenger Autos	617,244	558,239	11,737,625
Auto Trailers	595	513	19,273
Motorcycles	1,895	1,497	41,826
Tricars	1,061	845	11,806
Trucks	35,173	22,983	409,500
Truck Trailers	1,172	878	25,390
Buses	10,586	9,423	133,726
Total Vehicles	669,431	594,378	12,380,851
Extra Passengers	166,045	146,941	2,709,504
Freight Lbs.	68,607,331	54,078,501	926,722,350

$8,000,000 Damage to Highways

(Continued from page 9)

The district forces are now busily engaged in clearing the various roads for spring traffic.

NORTH SUFFERS AGAIN

The March storm brought added work to the northern districts, still laboring to extricate their roads from the slides and slipouts of the December and January-February storms. To District IV, it brought some 200,000 yards of additional slides, scattered over the Coast Route 56; the Hecker Pass, Route 32; the Bay Shore, Route 68; the Skyline, Route 55; and Routes 42, 44, and 116 leading into the California State Redwood Park near Santa Cruz.

Some eleven additional power shovels and twenty-five trucks were rented and put to work on the repair of these roads. Traffic was delayed for short intervals, and now all of these routes are traversable.

In District X

In District X high water over various roads required the employment of some 125 additional flagmen to warn traffic. Sections of overflowed pavements on Route 4, north and south of Merced, necessitated the detouring of traffic, as did similar conditions on Routes 122, 123 and the Pacheco Pass road, our Route 32.

Men worked day and night marking the edges of overtopped pavements with lanterns, and holding equipment in readiness to tow the unlucky who might stall their cars in the flood. The same forces and equipment were used in restoring the washed out shoulders and undermined pavement as soon as the waters subsided.

In District VI

In District VI, the counties of Kern, Fresno and Kings took the brunt of the storm as it crossed east of the mountains. Pavements were overtopped and undermined by the flood waters on Route 4, south of Madera; the General Grant Road, Route 41; the Huntington Lake Road, Route 76; and Route 10, west of Coalinga.

South of Madera, on Route 4, Cottonwood Creek overflowed its banks and backed up for more than a mile behind the Southern Pacific Railroad embankment, adjacent the highway. The embankment finally gave way, flooding the highway and forcing the detouring of traffic.

On Route 41, the Kings River again carried away the approach to the structure at Minkler, making the third time this winter that this particular approach has washed out. Route 76, the road to Huntington Lake, was closed by slides and washouts.

On Route 10, west of Coalinga, Waltham Creek washed out three spans of a concrete bridge in the canyon, closing the route. All the routes were again open for traffic in a short time, some 4 power shovels, 55 trucks, 26 tractors, and 31 graders being used in the repair work.

RECORD SNOW FALL

While the districts mentioned were contending with slides and floods, Districts II, III and IX were busily engaged in handling the heaviest snowfalls of the year. During the early weeks of March, some 7 to 20 feet of snow fell in their respective territories. Late reports from District III indicate some 574 inches of snow for this season, 434 inches of which has fallen since February. Again in District IX, some 260 inches came down in the same period with a record of 300 inches for the season.

The response of the Maintenance organization to the March challenge has been a source of pride to the Division of Highways. This storm, which within a few days time damaged State highways to the extent of $4,000,000, was the heaviest within our experience.

While practically all of these routes are now open, months will be required for their final repair. It is hoped that the public will not be too critical of road conditions pending the completion of this work.



House washed onto highway on E Street near city limits of San Bernardino.

Visitor: "How do you manage to live during this depression?"

Farmer: "Well, last year we lived by faith, this year we live in hope, and next year we plan to live on charity."

Elevating Grader Cuts Down Road Excavation Costs

By H. B. MILNER
Resident Engineer

THE constant improvement of earth moving equipment is one of the reasons for increased efficiency in highway grading operations and for lower unit prices for excavation.

The development of the elevating grader has kept pace with the improvement of other earth moving equipment and today, in its own special field, it is still considered supreme as an economical method of excavating.

The modern machine differs but little from the older types in basic design, but improvements and modifications have increased its efficiency. Powerful tractors are now used as motive power, replacing the horses and mules of the old era, and the belt is operated by an independent motor.



1—Elevating grader constructing protective dyke across head of Middle Lake in Modoc. 2—Grader delivering roadside material for widening roadway across bed of Middle Lake. Rock wall bordering present road shown at left.

MODOC HIGHWAY WIDENED

The ideal set-up for this type of machine was furnished on the contract completed by Poulos & MeEwen, contractors, for widening the roadbed and constructing protective dykes across the dry bed of Middle Lake near Cedarville, in Modoc County, about 1.4 miles in length.

The original roadbed was confined by vertical rock walls averaging three feet in height and was dangerous to traffic, particularly in winter when snow and poor visibility increased the hazard.

The improvement eliminated this condition by widening the roadbed three feet on each side and providing gentle slopes to the fills. During occasional wet seasons the lakebed is covered with a foot to eighteen inches of water and the high winds sweeping up and down the valley drive the water from one end of the lake to the other and cause considerable wave action.

To prevent erosion of the newly constructed fills, protecting dykes were thrown up on each side of the roadway about 160 feet from the center line extending entirely across the lake-bottom. Several gaps 50 feet long were left in these levees and short levees were built opposite these gaps. This permits the passage of water from one side of the road to another, through culverts under the road, and still protects the shoulders of the road against waves.

An elevating grader, with an auxiliary motor for operating the 48-inch by 35-foot belt, and drawn by a 75-horsepower tractor, was used on the work. A heavy motor grader with a 12-foot blade spread and compacted the windrows placed by the grader.

LOW EXCAVATION COST

The machine excavated at an average rate of 500 cubic yards per hour, actual working time, although the contractors claim to have considerably exceeded this output on previous jobs. Nearly 38,000 cubic yards of material were placed at a contract price of ten cents per yard.

Elevating graders function best when excavating along the roadside and delivering to the fill by means of a belt, usually about 35 feet long. In flat borrow pits they are the most economical equipment for loading excavated material into trucks. Although their field of operation for the elevating grader is limited, their usefulness and efficiency on projects such as this are quite pronounced.

On another highway contract in Siskiyou County similar equipment moved material into the fill at the rate of over 5000 cubic yards per 8-hour day.

An old darky visited a doctor and was given definite instruction as to what he should do. Shaking his head he was about to leave when the doctor said, "Here, Rastus, you forgot to pay me."

"Pay you for what, boss?"

"For my advice," replied the doctor.

"No, suh! I ain't gwine to take it," and Rastus shuffled out.

Salesman: "How would you like some nice horseradish today?"

Lady Customer: "No thank you. We have a car."



DIVISION OF WATER RESOURCES

OFFICIAL REPORT

FOR THE MONTH OF

March, 1938

EDWARD HYATT, State Engineer



THE Division of Water Resources representing the Water Project Authority of the State of California, has continued engineering studies and negotiations in connection with the construction of the Central Valley Project under a cooperative work agreement with the U. S. Bureau of Reclamation. Under this agreement negotiations have been carried on with the owners of lands in the San Joaquin Valley for the acquisition of such lands and water rights as are needed for the project.

Construction work by the Bureau of Reclamation on the project was somewhat delayed by weather conditions. However, work was continued and considerable progress made on the construction of the Contra Costa Canal and the government camp for the Shasta Dam.

IRRIGATION DISTRICTS

The recent severe storms producing heavy runoff and causing considerable damage to agricultural interests in the valleys from floods, will prove beneficial in many respects to areas dependent upon summer irrigation for maturity of crops. Most of the large storage reservoirs are nearing or have already reached the spilling stage and the abundant snow pack in the mountains insures ample summer flow for those districts dependent upon direct diversion for their water supply.

CALIFORNINA COOPERATIVE SNOW SURVEYS

The storm period that began late in January, with storm after storm arriving in quick succession from the Gulf of Alaska, did not come to an end until the middle of February. After the deep accumulations of new snow had had time to settle sufficiently to allow of travel, men on skis and webbed snow shoes were sent out from different parts of the State to measure at various locations the increase in the snow pack due to the extended storms.

Further routine progress snow surveys were made at key snow courses during the last few days of February and the early days of March, by employees of the Division of Water Resources and those other organizations and parties participating in the field work of the California Cooperative Snow Surveys.

The results show that at the end of February, in every watershed of the Sierra the snow pack was in excess of the normal quantity to be expected by that date, while in those watersheds north of the American River, the snow pack was even then ahead of the normal snow pack to be expected by the first of April.

SUPERVISION OF DAMS

Our records disclose that all dams came through the severe floods without failure in major degree.

Work is progressing at a very rapid rate on the construction of the Copper Basin Dam of the Metropolitan Water District, Los Angeles, located in Copper Basin, tributary to Colorado River, in San Bernardino County.

With the opening up of the season in the Mono Basin, work will be resumed on the Long Valley and Grant Lake dams owned by the city of Los Angeles.

WATER RIGHTS

Supervision of Appropriation of Water.

Twenty applications to appropriate water were received during February, of which two of considerable importance were those of the Oakdale Irrigation District to appropriate 93,000 acre-feet per annum by storage at Beardsley Flat Reservoir site on Middle Fork of the Stanislaus River for irrigation and power purposes at an estimated cost of $2,900,000. During the month 13 applications were denied and 13 permits were issued. During the same period 9 permits were revoked and the rights under 7 were confirmed by the issuance of license.

SACRAMENTO-SAN JOAQUIN WATER SUPERVISION

During the past month activities have been wholly in the office assembling the field data gathered during the summer months in order to compile a mimeographed report showing the diversions, acreage irrigated, stream and return flows in the Sacramento and San Joaquin valleys.

The sampling of water in the delta for salinity is being carried on at all regular stations to record the retreat of salinity.

FLOOD CONTROL AND RECLAMATION

Maintenance of Sacramento Flood Control Project.

During this period extremely high stages were reached in the flood channels of the upper Sacramento Valley, and it was necessary to maintain full patrol day and night from March 18th to March 28th.

Relief Labor Work.

During this period about 70 relief laborers were employed in patrolling levees and in miscellaneous emergency work and, in addition, for about five days a crew of 50 men was stationed at Colusa for emergency work. It was not possible to continue with channel clearing work on the Feather River during this period, on account of high water.

Sacramento Flood Control Project.

The work of removing the levees in the Feather River overflow channel south of Marysville in District 784 was completed during this period at a cost of approximately $18,000. A small amount of work remains to be done, which will be deferred until the weather is favorable. Construction of the timber bridges in the Dry Creek project near Wheatland has continued and all will be completed within about ten days.

Emergency Levee Repairs.

Under Executive Order No. E 177 work is continuing in making repairs to levees in Glenn, Shasta, Butte and Tehama counties, and at this date approximately $60,000 has been expended out of the total of $150,000. The work is now proceeding rapidly due to the favorable weather, and it is expected that all work will be completed by April 20th.

With the money provided by the State emergency fund, this office has undertaken the protection and patrol of the levee on the west bank of the Sacramento River from Colusa to Butte City. A number of breaks were prevented during the extremely high water commencing on March 18th.

Levee protection work along the San Joaquin River south of Stockton was commenced on March 16th under an emergency allotment of $20,000, and is still under way. During this period a number of levee breaks were averted with the assistance of State forces, on Roberts Island, the Stewart tract, Reclamation District No. 17, the Fink tract, and on the levee between Paradise cut and the Banta-Carbona irrigation intake.

R. M. Gillis Wins Promotion to Post of Construction Engineer

MR. R. M. GILLIS, for the past five years District Engineer of the Division of Highways at Fresno, has been promoted to the position of Construction Engineer, the position left vacant by the death of Mr. C. S. Pope.

Mr. Gillis is a graduate of the Massachusetts Institute of Technology and has had long experience in engineering work with an outstanding record in highway engineering, particularly in Washington and California.

He was first employed in California on April, 1929, as Assistant District Engineer, District X. and on November, 1929, he was promoted to the position of Assistant Construction Engineer at Headquarters; in 1935, he was promoted to District Engineer at Fresno.

He brings with him to the new position a thorough knowledge of both the District and Central Office problems, a wide acquaintance among the highway personnel and a proven ability in highway construction.

Mr Earl T. Scott, who for the past three years has been District Maintenance Engineer in District VII, has been promoted to the position of District Engineer at Fresno.

Mr. Scott is a graduate of Stanford University with approximately 22



R. M. GILLIS

years of experience in highway engineering. He has been with the Division of Highways since 1914 with the exception of 19 months during the World War when he was in the service and approximately nine months beginning in July, 1921, when he accepted employment with the U S. Bureau of Public Roads. He has had experience in all phases of highway engineering.

Arroyo Seco Highway

(Continued from page 21)

The Arroyo Seco Highway will follow down the Arroyo Seco, from Pasadena, through Victory Park, skirt the back edge of Sycamore Grove, and connect with San Fernando Road and North Figueroa Street leading to the center of metropolitan Los Angeles. When completed, the highway will be one of the most modern in the nation. There will be no grade crossings throughout its entire length.

A total of $1,112,000 has been allocated for the Arroyo Seco project. The contract now under way calls for the expenditure of $118,000 and includes the construction of three bridges and two blocks of grading.

Highway Bids and Awards for March, 1938

LOS ANGELES COUNTY—Two bridges, an equestrian and pedestrian subway with approaches to be constructed on Arroyo Seco Parkway between Arroyo and Grand Avenue. District VII, Route 205, Section S. Pas. C. O. Sparks and Mundo Engineering Co., Los Angeles, $117,158; John Strona, Pomona, $123,883; Oscar Oberg, Los Angeles, $110,-848; Griffith Co., Los Angeles, $113,251; Claude Fisher Co., Ltd., Los Angeles, $112,-886; George J. Bock Co., Los Angeles, $120,-930; Byerts & Dunn, Los Angeles, $112,-629; Oswald Bros., Los Angeles, $130,892; W. E. Hall Co., Alhambra, $116,959; Minnis & Moody & Werner & Webb, Los Angeles, $119,968; Carlo Bongiovanni, Los Angeles, $118,049; United Concrete Pipe Corporation, Los Angeles, $114,211; Fred E. Potts Co., Los Angeles, $121,716. Contract awarded to J. E. Haddock, Ltd., Pasadena, $109,837.40.

MARIN COUNTY—A timber bridge with concrete deck across Stemple Creek, about one mile north of Tomales consisting of 11 nineteen-foot spans and grading approaches and applying road-mix surface treatment thereto. District IV, Route 56, Section D. Peter J. McHugh, San Francisco, $17,942; Franzini and Fredenburg, San Rafael, $18,-372; A. Soda and Son, Oakland, $20,503; Palo Alto Road Materials Co., Palo Alto, $20,564; Parish Bros., Los Angeles, $20,-735; Chas. L. Harney, San Francisco, $20,-743; Lee J. Immel, Berkeley, $21,057; B. A. Howkins and Co., San Francisco, $21,-705; C. C. W. & H. H. Haun, San Francisco, $21,785; E. T. Lesure, Oakland, $23,-769; E. A. Forde, San Anselmo, $19,055; Valley Construction Co., San Jose, $19,859; Pacific States Construction Co., San Francisco, $19,931; Clausen and Corfield, Berkeley, $20,842; F. J. Maurer and Son, Inc., Eureka, $20,930; Claude C. Wood, Stockton, $21,680. Contract awarded to Albert H. Siemer and J. Carcano, San Anselmo, $17,-220.50.

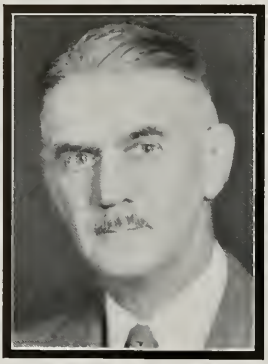
MONTEREY COUNTY—Between five miles and 5.9 miles west of Greenfield, about 0.9 mile to be graded. District V, Feeder road. Young and Son Co., Ltd., Berkeley, $16,802; Mountain Construction Co., Sacramento, $17,435; M. J. Ruddy, Modesto, $17,-640; Bodenhamer Construction Co., Oakland, $24,609; Guerin Bros., San Francisco, $24,549; John Jurkovich, Fresno, $22,724; Chas. L. Harney, San Francisco, $20,694; Valley Construction Co., San Jose, $21,750; George K. Thompson and Co., Los Angeles, $20,640; L. C. Karstedt, Watsonville, $17,-493; Claude C. Wood, Stockton, $23,156; George J. Bock Company, Los Angeles, $24,-294; Martin Bros. Trucking Co., Long Beach, $31,045; Triangle Rock and Gravel Co., San Bernardino, $28,676; N. M. Ball Sons, Berkeley, $21,757; Granfield, Farrar and Carlin, San Francisco, $19,623; Harms Bros., Sacramento, $17,963; Minnis & Moody, Los Angeles, $19,997. Contract awarded to J. L. Conner and Sons, Monterey, $15,317.16.

NAPA COUNTY—Three bridges, one across Dry Creek, one across Bale Slough Overflow and one across Bale Slough, between 6 and 15 miles north of Napa to be widened. District IV, Route 49, Sections B, C. M. J. Lynch, San Francisco, $20,-359; C. W. Calleti and Co., San Rafael, $23,360; Claude C. Wood, Stockton, $21,012; Carl N. Swenson Co., San Jose, $21,950; Brown and Lambretti, Mill Valley, $21,998; Peter J. McHugh, San Francisco, $24,059; Pacific States Construction Co., San Francisco, $24,339; Rock and Gravel Trucking Co., Oakland, $24,402; C. C. W. & H. H. Haun, San Francisco, $26,412. Contract awarded to Palo Alto Road Materials Co., Palo Alto, $19,947.93.

SAN BENITO, MONTEREY, SAN LUIS OBISPO, SANTA BARBARA COUNTIES—At various locations, diesel oil to be applied to roadside vegetation for a distance of about 242.6 roadside miles. District V. Pacific Truck Service, Inc., San Jose, $8,418; Lee J. Immel, Berkeley, $7,797; Western Motors Transfer Co., Santa Barbara, $10,-660; Oilfields Trucking Co., Bakersfield, $7,624; L. A. Brisco, Arroyo Grande, $9,-970; Bradley Truck Co., Inc., Santa Maria, $9,125. Contract awarded to Bert Hale, Pismo Beach, $6,658.50.

TULARE COUNTY—Between Morton Street in Porterville and Mulberry Street, about 0.9 mile to be graded and surfaced with plant-mixed surfacing on crusher run base and road-mix surface treatment to be applied to the shoulders. District VI, Route 129, Section Ptrv, C. Oilfields Trucking Co., Bakersfield, $40,819; Griffith Co., Los Angeles, $34,693; Piazza and Huntley, San Jose, $36,223; Union Paving Co., San Francisco, $41,217. Contract awarded to N. M. Ball Sons, Berkeley, $33,235.60.

In Memoriam



Charles Stockton Pope

Charles Stockton Pope, Construction Engineer of the Division of Highways since 1923, passed away on March 16, 1938, at Riverside, while on an inspection trip of recent storm damage to highways in southern California.

Mr. Pope was born August 10, 1874, at Fort Stockton, Texas, the son of Dr. Benjamin F. Pope, a distinguished surgeon in the U. S. Army. He received his early education at army schools, private and public schools, graduating from Stanford University with an A.B. in C.E. in 1897. While at Stanford, he was a member of the Chi Psi fraternity, varsity track team in 1896 and 1897, and was elected perpetual class president in his senior year.

Mr. Pope began his professional career in 1898, on land and irrigation surveys in Kern County. In 1900 and 1901 he was assistant engineer on power projects for the Standard Electric Co., continuing similar work in 1902 and 1903 for the North Shore Railroad and Stanislaus Water and Power Co. During 1904 to 1906 he was engaged as surveyor for the King of Arizona Mine, and in private practice at Los Angeles. In 1907 he entered the engineering department of the city of Los Angeles where he was principally engaged as highway engineer in charge of paving work until the year 1915. From 1916 to 1921 he was associated with Warren Brothers as district engineer on promotion and consulting work for asphalt pavement projects in California and Nevada.

In January, 1922, he began his service with the California Highway Commission as Assistant Engineer, specializing on asphalt pavement work. In September, 1923, when the Construction Department was organized, Mr. Pope was appointed head of this department as Construction Engineer in charge of the Materials and Research Laboratory and of all highway construction, except major bridges. The laboratory assignment was terminated in 1928 when the Materials and Research Department was organized. As Construction Engineer, Mr. Pope also had charge of the State Prison Camps, involving supervision of the construction of many miles of heavy mountain roads and of problems concerning the rehabilitation of prisoners.

To his keen, analytical mind and his constant interest in research can be attributed many of the improved methods of construction of our highways. His continued effort and study are primarily responsible for the development of the modern high type asphalt concrete pavement as now constructed by the State. His numerous technical and scientific papers, articles, and discussions contributed materially to the knowledge of highway engineering and are widely recognized as authoritative.

He was an active member of the American Society of Civil Engineers, serving as president of the Sacramento Section in 1924 and on numerous committees. He was also a member of Sacramento Lodge No. 40, Free and Accepted Masons, the Sutter Club, San Francisco Engineer's Club, California Museum Association, and a former member of the Sutter Tennis Club and the Del Paso Country Club.



Samuel Alexander Hart

Early on Sunday morning, March 20, 1938, Samuel Alexander Hart succumbed to the effects of a long illness at his home in Sacramento, California. Although in poor health for a number of years, he had continued his duties in the office of the State Engineer as Senior Engineer, Supervision of Dams, till less than three weeks before his death.

The son of Henry Eldredge and Anzolette (Hayward) Hart, he was born at Stockbridge, Wisconsin, December 14, 1885, where he received his early education. In 1903 he came to California and completed his preparation for college, entering the University of California with the class of 1910, but the necessities of self support prevented his graduation until 1911 when he received his B.S. degree.

Although he graduated in mining, Mr. Hart chose to follow irrigation and hydraulic engineering, devoting the major portion of his professional career to these two branches.

From the time of his graduation until the United States entered the World War, he followed engineering work in Northern California and Arizona, served as Chief Engineer of the Waterford Irrigation District for three years; Assistant Engineer of the South San Joaquin Irrigation District for two years, chiefly on the construction of Woodward dam. After the war he was employed in private practice with Joseph W. Gross, Consulting Engineer, for fifteen months, a few months with the State Division of Engineering and Irrigation on reconnaissance surveys and from February, 1922, to November, 1928, he was employed in the Engineering Department of the City of Sacramento, rising from the position of Assistant Engineer to that of City Engineer. From November, 1928, to April, 1930, he served as Sanitary Engineer for the City of Berkeley in charge of the design and construction of a storm sewer system. Upon completion of this work he was appointed to the position of Senior Engineer of Hydraulic Structure Design on Supervision of Dams in the Division of Water Resources, Department of Public Works, continuing in this position till his death.

Mr. Hart joined the war forces of the United States in August, 1917, and was commissioned First Lieutenant of Co. H, 23rd Engineers. The regiment went overseas on March 30, 1918, and was engaged for the greater part of the time in building and maintaining communications to the front lines. The regiment took an active part in the battles of St. Mihiel and the Meuse-Argonne, returned to the United States and was disbanded in June, 1919, Mr. Hart receiving his honorable discharge on the 17th of that month.

On August 5, 1921, he married Elsie A. Silman who, with their two sons, Samuel A. Jr., and William E., survives him.

Mr. Hart was a member of Union Lodge No. 58, Free and Accepted Masons of the State of California, the Scottish Rite Bodies of Sacramento and the Ben Ali Shrine. He was also a member of the American Society of Civil Engineers and affiliated with the Sacramento Section. His friendly greeting and genial smile will be missed by his friends and associates.

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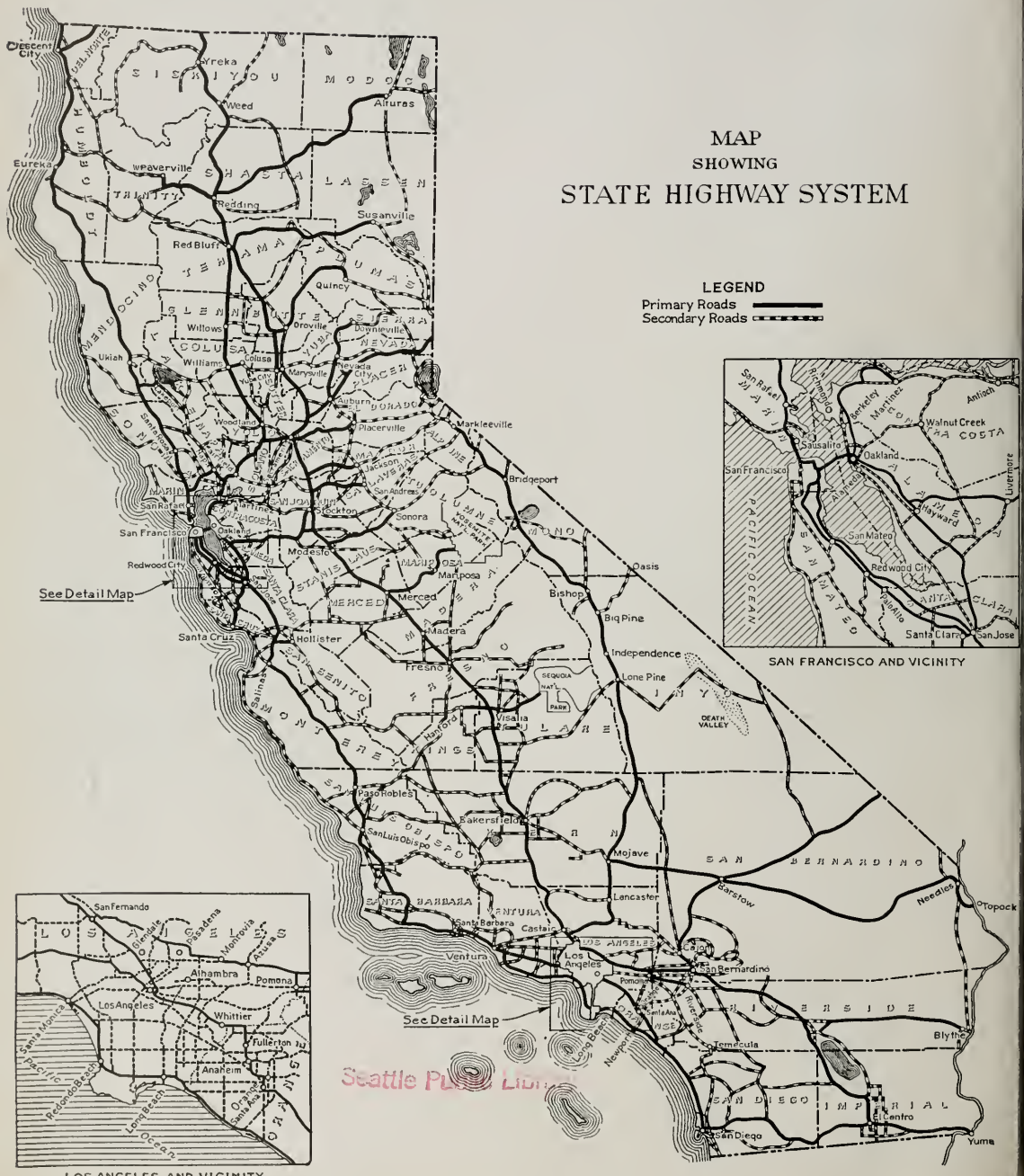
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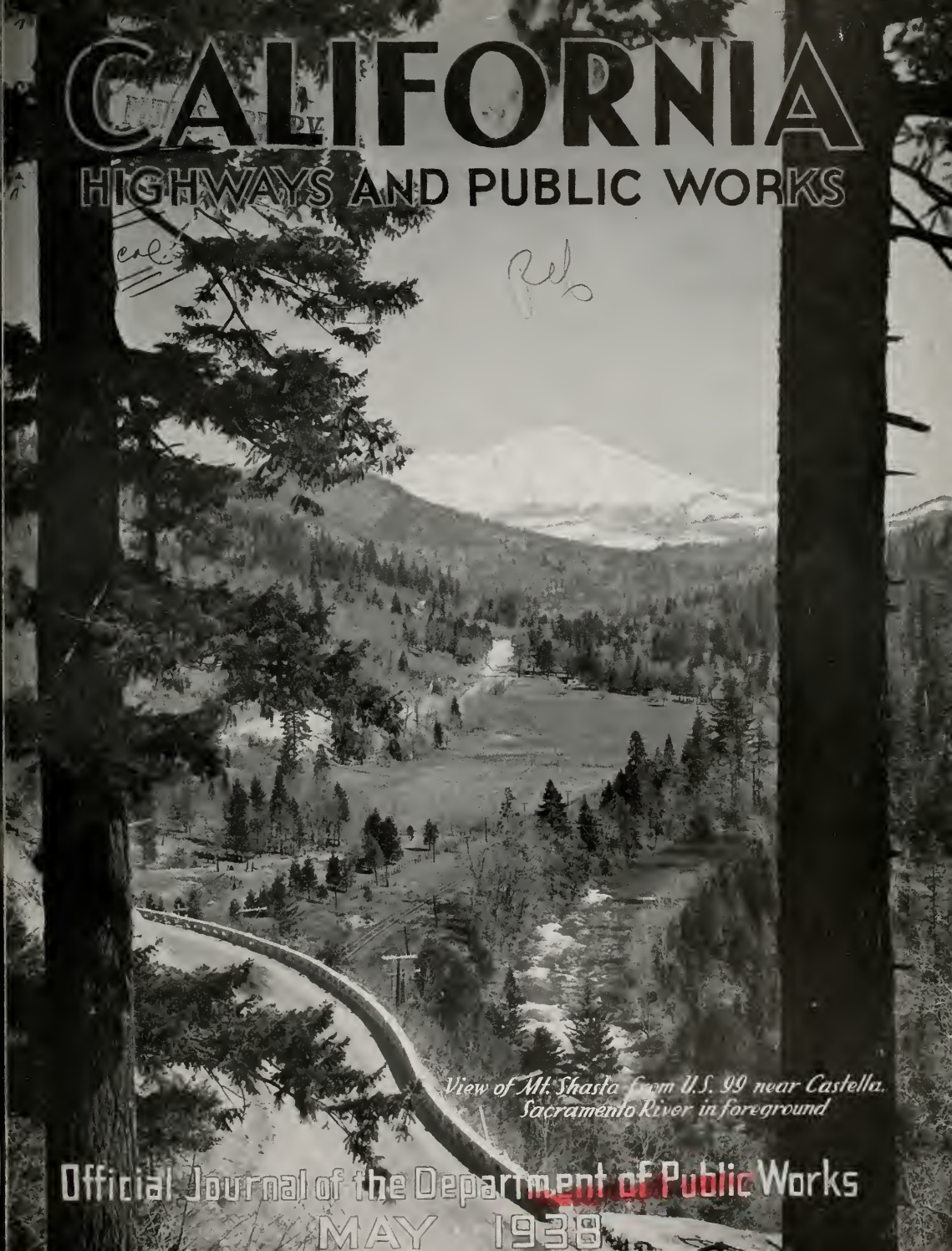
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CALIFORNIA

HIGHWAYS AND PUBLIC WORKS



View of Mt. Shasta from U.S. 99 near Castella. Sacramento River in foreground

Official Journal of the Department of Public Works

MAY 1938

MAY 17 1938

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways of the Department of Public Works, State of California

EARL LEE KELLY, Director C. H. PURCELL, State Highway Engineer JOHN W. HOWE, Editor K. C. ADAMS, Associate Editor

Published for information of the members of the department and the citizens of California

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CONSTRUCTION STARTS RELIEVING CONGESTION NEAR SAN RAFAEL AND BREAKING BAD BOTTLENECK

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By JNO. H. SKEGGS, District Engineer

THE STEADY increase of traffic between metropolitan San Francisco and the Redwood Empire, particularly the vacation resorts along the Russian River, together with the change in characteristics of traffic flow resulting from construction of the Golden Gate Bridge, has made it necessary to provide greater capacity on U. S. Route 101 in the vicinity of San Rafael.

Before the opening of the bridge, the limited capacity of the ferries governed the flow of traffic more than the capacity of the highway approaches. Now it is not necessary for miles of cars to patiently await their turn for the ferry at Sausalito and the need for highway development to remove congestion en route is more pronounced.

CONGESTION NEAR SAN RAFAEL

Studies show conclusively that the most constricted section of this only artery between the Golden Gate Bridge and Santa Rosa is from Ignacio through San Rafael.

Improvement of other sections might be economically sound, as they might be on many other sections of highway throughout the State, but with the limited funds available, betterment of the most congested portions must come first. Accordingly, this project utilizes all funds available in removing and relieving the worst constrictions.

Earlier commencement of work had been planned, but postponement was unavoidable because of the necessity of awaiting assurance that federal aid would be forthcoming, without which the improvement could not be made.

SUNDAY TRAFFIC 18,000

Traffic on this seven mile stretch of two-lane pavement between Ignacio and San Rafael reaches an intensity of 1700 cars for a one hour period with a sustained flow of 1250 or more per hour over an eight hour period.

Sunday traffic in June and July approximates 18,000 vehicles per day and even week day traffic often exceeds the comfortable carrying capacity of a two-lane highway.

Obviously, more lanes are essential and as the existing pavement is in good condition and, in general, on good alignment, the present project consists of widening to three lanes, with four lanes to be provided where sight distance is limited. This will provide opportunity for passing, resulting in greater capacity and will



JNO. H. SKEGGS

make travel safer by eliminating the tendency of vehicles moving in groups to "bunch up"—a common cause of accidents.

DIVIDED ROADWAY PLANNED

Immediately north of Ignacio the Black Point Cutoff diverts considerable traffic and the existing two-lane pavement from there north has sufficient capacity for the present. However, for 0.4 mile north of the wye a third lane will be added, and to provide a faster get-away and space for safe adjustment of speeds, the pavement will be widened to 50 feet for three-quarters of a mile south of the wye.

It is planned that eventually a divided roadway will be constructed and, as the terrain does not lend itself to dual roadways separated by appreciable horizontal or vertical distances, the roadbed will be constructed to a width sufficient to permit two 23-foot pavements with seven-foot shoulders and a four foot center division strip.

The excess excavation resulting from widening the major cuts for present requirements enables this ultimate grading width to be done at a very small additional cost. Permanent landscaping can now be done as funds become available.

At St. Vincent's Hill, midway between Ignacio and San Rafael, the existing curves will be flattened to a minimum radius of 1500 feet. This change, together with widening and lowering the roadbed, entails 87,000 cubic yards of excavation, most of it to be sliced from present slopes which rise over 100 feet above grade. The balance of the 273,000 cubic yards of excavation is distributed throughout other widening and the new roadway within San Rafael.

SECTION IN SAN RAFAEL

Maximum congestion occurs in San Rafael where numerous intersecting streets, stop signals, grade crossings of railroads, etc., prevent free flow of traffic and a mere widening of the present highway would not satisfactorily improve conditions. Correction demands an unobstructed freeway and its selection requires vision and caution in order that the improvement be of permanent benefit.

Intensive studies of possible satisfactory routes showed that all converge near a common point in the north central part of San Rafael.

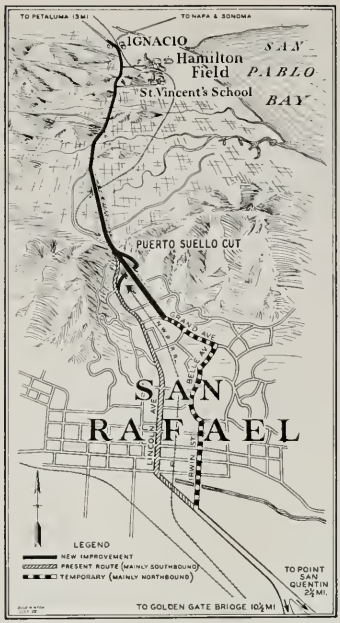
Proper development of any of these routes entails major structures and expenditures greater than can be made with funds now available. However, by fully improving a new half mile section from the north city limits to Grand Avenue from which point one of the future routes can be continued, the congestion will be alleviated and a start made on complete elimination of the constriction.

ALTERNATE ROUTE PROVIDED

During peak periods (Sundays and holidays), northbound through traffic will be routed via Irwin Street, Belle Avenue, and Grand Avenue, and southbound traffic will continue to use the present highway. At times of extreme peak travel, however, it will be possible to utilize both routes for traffic in the same direction. The addition of this temporary route necessitates minor improvement of Belle and Grand Avenues.

To enable present and future traffic from west of the railroad to safely reach the highway to the north, it will be carried under the new section of highway by a new 1000 ft. connection and allowed to merge with other traffic at the north limits of the city.

The new section of highway cuts through built up portions of the city for several blocks and a service road will be constructed on the east side



Perspective sketch of Ignacio-San Rafael project.

View taken from side of present highway looking northward through Puerto Suello Pass at northerly city boundary. Dotted line shows position of proposed extension southward in to San Rafael.

to enable the highway to function as a freeway. As this section lies adjacent to the railroad, no service road is necessary on the other side.

CONSTRUCTION DETAILS

Numerous widths of pavement result from the use of both three and four-lane sections, the several short line changes, the division (or provision therefor), of certain portions of the four-lane pavement, full utilization of the existing 20 foot Portland cement concrete pavement and the several two-lane roads.

Altogether there will be nearly six miles of Portland cement concrete widening strips constructed to widths of 11, 13, 15, and 22 feet and almost three miles of asphalt concrete pavement, 0.33 ft. thick, in widths of 11, 13, 15, 17, 30, and 50 feet.

Surfacing of the new section of highway, together with its service road, the Lincoln Avenue connection, and Belle and Grand Avenues, all within San Rafael, will consist of 0.21 ft. of plant mix.

Subbase for all pavement will consist of one-half foot of selected material to be obtained from a suitable deposit near the north end of the project. Three-foot shoulders of this material will be constructed throughout.

Approximately 15 per cent of the cost of the work will be involved in





View taken from top of cut through the saddle at Puerto Suello on westerly side of highway looking southward. Section shown in dotted line represents approximately that portion of reconstruction through San Rafael.

the widening of six existing bridges and the construction of an underpass as a part of the Lincoln Avenue connection. Clearing and demolition of numerous buildings on the new right of way within San Rafael add to the varied work involved and altogether there are 70 contract items.

The time limit of 150 working days will make this improvement a fast moving job, requiring double shifting and careful coordination by the contractor. Particularly difficult, will be the maintaining of heavy summer traffic throughout the length of the project.

Bids were opened April 27th and the work will soon proceed under the supervision of District Construction Engineer E. G. Poss, and Resident Engineer W. A. Rice.

MODOC HIGHWAY COMPLETED

By MATHEW FREDERICKSEN, Resident Engineer

A NEW 10-mile unit of State Highway between Hot Creek and Alturas, in Modoc County, on U. S. Highway 299, has been completed. This unit was particularly significant in that it was the last remaining unimproved portion on this State route.

Aside from affording transportation facilities to a large agricultural section and access to a widely known recreational area, U. S. Highway 299 is of interstate importance in that it directly affords connections with two states—Nevada to the east and Oregon to the north.

The old existing road replaced by the the new unit, was characteristic of rural roads as existed prior to the advent of motor transportation. Through years of maintenance work and betterment contracts, since the inception of the route into the State Highway System, a fair surface had been obtained, but lack of drainage required reworking of this surface once or twice a year. The other characteristics, however, rendered the section wholly inadequate and unsafe for present-day needs and requirements.

The new alignment consists of long tangents and long radius curves. The grades were designed to insure ample sight distance, and with a roadway section that will expedite snow removal. All of these features were designed and planned to yield safety and economy to its users.

An important feature of the project was the use of local deposits of pit-run gravel for the base course. These deposits, characteristic of the eastern area of the Cascades, are irregular in area, shallow in depth, and are found at random locations, but they usually have the characteristics that make them suitable for base construction. Aggregate from the deposits was crushed and graded for the top plant-mixed bituminous surface.

(Continued on page 27)



Here is an excellent view of one of many Cuesta grade curves now being eliminated.

Progress on Cuesta Grade

By B. W. BOOKER, District Construction Engineer

THE August, 1937, issue of California Highways and Public Works included an article describing the reconstruction of Cuesta Grade on the coast highway (U. S. 101). The contract was awarded on May 26, 1937, and construction was just getting well started at the time the article appeared in print.

A description of the preliminary investigations and construction planned as a result of these investigations was given in detail in the previous article.

It is interesting at this time to comment on the items of principal importance which were covered in the previous article and to draw some conclusions as to the effectiveness of the preliminary investigations in accomplishing the purposes planned. The major items of interest which come under this heading follow:

Progress—Construction operations were started on June 15, 1937, and have been confined to date to grading, drainage and contingent items. At the present time, in spite of a three months' shut down due to an unusually severe winter, the roadbed items listed above are approximately 85 per cent complete, the entire project 66 per cent complete and the job about 3 per cent ahead of schedule. This is considered to be satisfactory progress in view of the difficulties of construction, involving movement of a considerable portion of the excavation from the top of the cuts to the bottom of adjacent fills. The maximum vertical movement of this nature was from 150 feet above grade to 200 feet below grade with the added difficulty of having to cross traffic en route.

The maximum output on roadway excavation was 150,000 cubic yards per month working two shifts with $2\frac{1}{2}$ cubic yard shovels and four 9 by 12 cubic yard carry-alls supplemented by the necessary trucks and bull-dozers.

The excavation of fill treatment trenches, which are 90 per cent complete to date, also served to retard progress in the early stage of the construction.

Present indications are that the project will be finished about the middle of September, approximately one month earlier than the date for completion.

Traffic—In spite of the construction difficulties involved in carrying traffic through a job of this magnitude there have been no traffic delays of any importance to date. When the severity of the storms of last winter is given due consideration, this is an achievement which speaks well for the planning and execution of the work.

Slides—The preliminary estimate of quantities comprised 915,000 cubic yards of neat roadway excavation and included a supplemental item of 90,000 cubic yards for slide contingency.



Construction scenes on Cuesta Grade. Upper—Looking south from Station 216. Note slide in upper left with roadbed cut below. Center—Heavy grading equipment in operation. Lower—Unloading top of slide at Station 210. Grade of finished road is 25 feet below existing road. This project presented Division of Highway engineers with many backfilling, cribbing and fill treatment problems.



Looking south from existing Cuesta Grade. Metal crib and wattles adjacent to railroad just south of overhead.

At this writing with 85 per cent of the excavation completed and the winter storms over, it appears that there will be approximately 200,000 cubic yards of slide removal and prevention work necessary over and above the neat roadbed quantities or an over-run of 110,000 cubic yards. This represents less than 10 per cent of the total preliminary estimated quantities and is ample justification for the time spent on preliminary investigations when the character and magnitude of the work are considered.

Many of the slides have been in the nature of mud flows in thick strata of top soil that occur in concentrated deposits in the original formation. These occur as breaks of limited area in the face of the cut bank and are treated by effecting drainage and cupping out the slide down to the tight material.

Several more extensive slides occurred necessitating flattening the slopes, taking the weight off the top by benching and correcting drainage by capping springs and placing subsurface drains.

Fill Treatment—Two types of fill treatment were employed which will be briefly described. Both methods were designed by Mr. O. J. Porter of the Testing and Research Laboratory and are worthy of a separate article devoted entirely to their discussions.

The method employed generally throughout the project on major fills having poor foundation, was to excavate a trench with draglines and bulldozers through the mucky material with laterals and cross trenches along lines determined by the preliminary borings. The trenches varied from ten to twelve feet in width with side slopes varying according to the material and degree of saturation. The trenches were backfilled with gravel to a depth of four to five feet and a perforated pipe placed in the rock trench in most cases. The rock was then covered with straw and then backfilled with the trench spoil. Excess muck unsuitable for roadway fill was wasted into fill struts at the base of the roadbed fill.

The only departure from the above method was to vary the location and extent of the trenches to follow the seepage encountered while the excavation was in progress.

A DIFFICULT PROBLEM

The excavation of the fill treatment trenches presented a difficult problem due to the flow of the saturated material into the open trench, particularly on side hill cutting. This was overcome, in the most obstinate cases, by digging a sump at the upper end of the trench, draining the water from the sump and excavating the trench in short sections from the lower end and backfilling immediately behind excavation.

In order to place fill treatment at the Station 250 fill, it was necessary to construct a sump as described above and strip the mucky material for the entire area between slope lines in the canyon floor down to tight material before the drains were placed. Approximately 43,000 cubic yards of saturated blue muck were excavated and placed in a fill strut extending to the west canyon wall.

DRAIN FILL FOUNDATION

The second method of draining saturated fill foundations was employed only at Station 175, in School House Draw. The highway traverses a flat open draw 650 feet in length along highway centerline on a maximum centerline depth of fill of 60 feet. Test borings showed the foundation to consist of a crust of from 8 to 10 feet of porous shale particles overlaying a 50 to 60 feet depth of plastic to semiplastic clay.

It was considered impractical to stabilize the foundation by the previously described method on account of the depth of trenches necessary and the grade required for the outfall ditches. Sand piles were therefore studded throughout the foundation area and connected by a system of drains at the approximate level of the original ground. The piles were formed by driving a hollow seamless mandrel 70 feet long and 16 inches in diameter through the clay strata and filling the opening with sand as the mandrel was withdrawn. 300 of the sand piles were placed in the fill foundation and paid for as extra work under the contract.



Looking south from Station 172. New Cuesta Grade construction ready for fine grading.

NO SLIP OUTS OF FILLS

The most important point in connection with the fill treatments is that practically all of them have functioned as planned. There have been no slip outs of fills throughout the job excepting in one small fill where no fill treatment was provided. The settlement of fills has been nominal, the maximum amount of 2 feet occurring in School House Canyon with no indication of upheaval of areas adjacent to the fill.

The total quantities of fill treatment placed will closely approximate the estimate made from the preliminary investigation.

FILL TREATMENT RECORD

A record of fill treatment placed and recorded flow of drainage from the fill treatments follows:

		Seepage Flow, Gallons Per Minute		
		Minimum	Maximum	
Station	Length of trench	before rain	after rain	Present
159+80	190	0	0	0
163+89	200	0	0	0
167+25	250	0	6.0	0.9
175± (School House)	Sand Piles	0	15.5	0
192+65	260	10.4	20.3	16.2
203±	820	1.4	15.8	13.9
214±	600	5.0	23.7	15.8
220±	700	6.2	71.6	31.2
229+82	420	6.2	48.0	39.0
249+90	700	11.0	62.4	20.8
257+00	320	8.2	44.5	11.6
263±	375	4.2	12.4	5.0
282+85	280	10.2	17.2	10.2

Metal Cribs. The construction completed to date includes two metal cribs. The first, adjacent to the overhead being constructed across the Southern Pacific tracks, is 150 feet long and from 9 to 26 feet in height. It was designed to retain the fill adjacent to the railroad and to effect a reduction in the required length of structure.

The second crib, 600 feet long and from 6 to 21 feet in height, makes it possible to construct a light fill over an old slide area with less danger of overload than would be possible if the fill were constructed entirely of earth.

Standard methods of construction were employed on both cribs with backfilling placed in 6-inch to 12-inch layers and compacted with pneumatic tampers.

Wattles. The fill slopes above the railroad washed badly during an early winter storm and muck was deposited to a depth of 6 inches over the tracks. Willow wattles were placed on the slopes consisting of bundles of second growth willows at

(Continued on page 28)



Cuesta Overhead superstructure. Note streamlined Daylight Limited in background.



Where Bay Bridge trains will enter and leave the easterly end of the span.

BUILDING BAY BRIDGE RAILROAD

BY THE early part of 1939 a three-quarter century old custom around San Francisco Bay will have been altered.

For the picturesque ferry boats which for decades have carried passengers between metropolitan Oakland and San Francisco will be replaced by smooth running electric trains plying across the San Francisco Bay Bridge.

Both Key System and Interurban Electric (Southern Pacific) will operate trains across the span at an average saving to passengers of 15 minutes.

Trains will operate directly from Alameda, Berkeley and Oakland to the terminal in San Francisco.

This structure, facing Mission Street and extending within the vicinity of Beale and Second Streets, will be longer than the Ferry Building, and will bring 50 per cent of the daily commuter traffic to within walking distance of their destination in San Francisco.

REINFORCED CONCRETE TERMINAL

Street cars will loop in front of the terminal over an elevated ramp. The ramp will have three tracks, with a capacity of four cars each.

The terminal is a reinforced concrete structure to be faced with granite. To date, all structural concrete in the building units has been placed up to and including the track floor, the highest floor elevation in the project.

Above the track floor the side walls and roof slab are within 20 per cent of completion. All steel framing over the train shed, with the exception of the east unit, has been erected, and the only steel construction for the viaduct remaining to be placed is that over South First and South Fremont streets.

TRAINS 63 SECONDS APART

Because the Bay Bridge railroad will of necessity handle as many as 17,000 passengers one way at a twenty minute period over one track, close headway schedules will be required. Ten-car trains will run as

close as 63 seconds apart. By way of comparison, New York subway trains have a 90-second headway.

To assure maximum safety and efficiency, the most complete automatic interlocking and signal system has been designed.

Replacing the old system of manually operated levers will be a trim control board, six and a half feet long and four feet and three inches high, designed so that the operator may sit before it as he would at a high-topped desk. Engraved on the face of the board is a track diagram with a signal knob or button placed at the entrance of each "route."

To "set up a route" the operator has only to press the signal knob at the entrance to the route and the completion knob at the exit to the route.

CONTROL BOARDS

Such a control board will be installed in the San Francisco Terminal. The design on this board will show the six tracks over which bridge trains will roll to discharge and pick up passengers. On it will be indicated the 36 track switches and 40 wayside signals which comprise the interlocking plants of the terminal and viaduct.

A similar board will be placed in the high signal tower now completed in the Oakland yards situated just opposite the Toll Plaza. It will differ only in respect to its diagram which will show a design of the yards comprising the storage tracks and the mainline tracks. The Oakland interlocking plant controls 36 track switches and 62 wayside signals.

Each train has its corresponding numeral or letter (numeral for Interurban Electric; letter for Key System) identified on the board. When the train leaves either terminus the operator presses the proper button identifying the train to the operator at the other terminus.

TERMINAL NOISE ELIMINATED

Trains will loop into the San Francisco Terminal from the bridge over a viaduct, so insulated as to eliminate noise to the greatest possible degree.

The trains will leave and enter the lower deck of the bridge at a point west of and paralleling the truck and "off" vehicular ramps.

East and westbound trains will share a common viaduct between the bridge and Clementina street at which point the viaduct separates to form a gigantic loop which will encompass the approximate equivalent of seven city blocks. San Francisco-bound trains from this connection take an easterly to westerly curve into the Terminal.

All foundations for the viaduct are practically completed, as is the neat work on the piers. The concrete crossing over Harrison is finished, and other crossings are rapidly nearing completion.

On the bridge proper, the trains will ply over two tracks on the south side of the lower deck, paralleling the truck lanes.

105,000 RAILROAD TIES

California redwood has been selected for the ties. On the bridge proper the ties are laid directly on the stringers, after the steel had received two coats of inertol.



Trains will leave the westerly end of the bridge over a viaduct paralleling the truck and "off" vehicular ramps.



The San Francisco Terminal, facing Mission Street, showing the center unit well under construction. Street car ramp in the foreground. East and west units not visible.

Each tie is dapped at either end. Ties are marked according to their position on the road-bed and enter the dapping machine in precise relation to the order in which they will be laid on the bridge. The depth of the dap is determined by the stringer, which has been previously surveyed, and upon this depth is also determined the elevation of the track. Depths vary from one-quarter inch to one and one-quarter inch. The dap in most cases is eleven inches wide.

A total of 150,000 ties or approximately 7,000,000 board feet of California redwood comprise the tie order for the Bay Bridge railroad. This is said to be the largest individual order made on the Pacific Coast in a decade.

On the bridge proper all ties have been laid to the center of Span W1-W2, and tracklaying operations on the bridge are in an easterly to westerly direction.

TONS OF RAILS

The running rail is a 90 pound rail, in 39-foot sections. The guard rail is a 90 pound relay. On the main bridge and San Francisco loop the running rails will have a total gross tonnage of 1830; the guard rails, 1315 and the contact rail (to be used by the Key System only) a gross tonnage of 1400 pounds.

The Key System, which now operates on 600 volts, will continue to do so over the bridge. The Interurban Electric will continue to operate on 1200 volts as at present over a catenary system.

An approximate total of 400,000 spikes weighing 160 tons will be used for the tracks on the main bridge alone.

Trim steel catenary bridges painted aluminum, are replacing the timber trolley poles used by the trains at present. Erection of the catenary bridges has been completed.

RAPID PROGRESS

In the East Bay yard, a major portion of the trackwork has been placed, and the connection with the easterly end of the bridge has been made.

Opening of the Port of Oakland Highway approach to the bridge is expected early in June. The viaduct of this highway, which passes over the yards and the main highway approach to the Toll Plaza, was constructed in conjunction with the railroad project.

The Bay Bridge railroad system, reputed to be the longest electric overwater railroad in the world, is another project built by the State Department of Public Works under the direction of Earl Lee Kelly. C. H. Purcell is chief engineer, Charles E. Andrew, bridge engineer and Glenn B. Woodruff, engineer of design.



Trains will roll in the San Francisco Terminal over six tracks arranged in pairs. This view of the elevated track level also shows the roof steel just erected.



This view looking down the East Bay Crossing shows ties and tracks in place.

OUTDOOR ADVERTISING

By JIM M. CALL, Supervising Inspector

SINCE the Outdoor Advertising Act became effective, more than four years ago, inspectors engaged in its enforcement have traveled over half a million miles attending to the displays which come within its scope. Some 200,000 displays have been viewed and approximately 30,000 violation notices have been issued.

Several thousand minor or technical infractions have been corrected through cooperation by advertisers, obviating necessity of citation. Countless small structures and signs were removed by owners during the first six months of the act's existence, this period having been allowed by legislature for organization and to acquaint the public with the nature and purpose of the measure.

About 25,000 paper or metal "snipe" signs have been removed by the inspectors, in conjunction with the Streets and Highways Code which provides for immediate removal of encroachments without notice. "Snipes" are miscellaneous small signs, announcing current local attractions, that pay no fee. Approximately 10,000 displays (not including quarter cards placed by candidates for public office) have been removed by State forces as a result of violation notice service.

50,000 EXEMPT DISPLAYS

Twenty-four thousand displays were under permit during 1937. Some 50,000 displays are being legally maintained exempt from permit payment. Of the latter, perhaps 5000 have been caused to conform to the location and copy provisions of the act through service of violation notices and personal contact.

All abandoned, unsightly, improperly located and other nonconforming displays have either been removed and destroyed or corrected. There is of course the usual run of violations but less than 2 per cent of these are of the location provisions. The majority of notices are necessitated through failure on the part of display owners to secure permits before installing displays. However, by a thorough study of conditions and careful programming of surveys of highways upon which the greatest number of displays exist, the inspectors are able to locate violations promptly.

Owners are therefore rapidly learning that it is much more economical to obtain permits before placing displays than to risk losing them through error or misunderstanding after receiving citations.

During the latter part of 1937 steps were taken to enforce regulation of the illumination provisions. This necessitated night surveys which have proved very successful and little if any opposition has developed.

LACK OF COOPERATION

The most difficult obstacle in enforcing these provisions is lack of cooperation on the part of operators employed to place lighted signs. Owners have on occasion failed to correct violations immediately upon receipt of notices due to installation of a violation in the same vicinity, subsequent to citation of their signs, which has not been viewed by an inspector.

Naturally it is the desire of operators to sell the sign the customer fancies. In doing so they are sometimes careless about regulations, without intent to violate. Prospective sign purchasers should avoid buying displays which might require alteration or perhaps removal, until they have reviewed the terms of the act.

Another serious problem is that of abuse of the fee exemption as it applies to "for sale" or lease advertising. Compliance on the part of realtors and others interested in this type of display could be greatly improved.

Exemption is afforded only to signs of this type which are used **exclusively** to advertise the sale or lease of the property upon which they are located. Such a display as **"This and Other Property for Sale"** may not be considered exempt from payment.

TWO SIGN CLASSIFICATIONS

Every advertising structure should conform to the location, strength and copy provisions; every sign to the location and copy provisions.

There are but two classifications of displays:

ADVERTISING STRUCTURE: When artificial support, such as poles, posts, angle irons, guy wires, or braces embedded in the ground or attached to the sides or roofs of existing structures such as barns, sheds, fences or trees, is necessary, the display is classed as an advertising structure, the annual fee for which is $1.00.

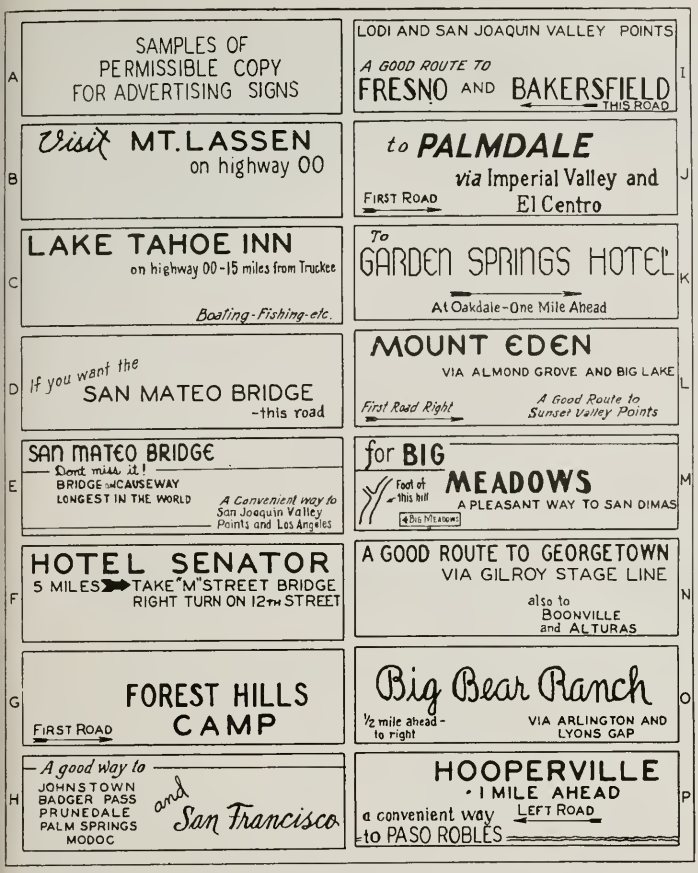
ADVERTISING SIGN: One which may be pasted, glued, nailed, tacked or similarly affixed flat against the side or roof of a building, or to a tree, fence, post, rock, bush, or similar support which was not primarily placed for the purpose of displaying advertising. All displays, painted directly upon existing natural or artificial features of the landscape, are also classified as signs, the annual fee for which is $.25.

EXEMPT DISPLAYS

Permit applications need not be filed for payment of exempt displays. However, these displays may not be placed or maintained nearer than 300 feet from the point of intersection of highway or highway and railway right of way lines, unless the property upon which they are to be installed or are maintained is subdivided into blocks and lots, or unless their installation will not decrease visibility at an intersection.

Subdivisions consisting of lots in excess of 20,000 square feet of area may not be recognized in the application of permissible location regulations. Neither structures nor signs may be placed upon or attached to public highway right of way fences nor may they encroach upon or overhang public highway rights of way.

It is not uncommon to observe four to eight small (1 by 1 foot) "for



sale'' signs on a short highway frontage. Although substitution of a larger sign structure at each end of the frontage would be more expensive, it is believed that the resulting improvement in appearance of the property would balance the expenditure.

SOURCES OF REVENUE

Although fee exempt displays outnumber those requiring number plates two to one, regulation of them must be financed from the ''Supervision of Outdoor Advertising Fund.'' There are but three sources of revenue to support the fund: Annual Advertising Structure and Advertising Sign fees; the license fee, $50 payable annually but which may be prorated on a monthly basis depending upon the time of the applicant's entry into the Outdoor Advertising Business; collection of fines imposed by courts and collected under this act, any violation of which is a misdemeanor.

It follows, then, that regulation of any increase in the number of payment exempt displays may only be financed through collection of fees on a corresponding increase in the number of displays requiring permit number plates. No revenue is derived from exempt displays under either the license or permit provisions.

''Snipe'' signs present a task for the Outdoor Advertising Section that could readily be disposed of through cooperation on the part of firms and individuals. This type of advertising is a ''hold-over'' from horse and buggy days. At a ten-mile gait the driver's undivided attention could be given them; on stopping to give old Dobbin a blow, the driver could size up a candidate, decide on a brand and read the printer's label. It is different now. Except to hitch hikers and the occasional horse-drawn vehicle driver an array of bills or cards is just a blur.

Permits may be granted for ''snipe'' signs designed and located in accordance with the provisions of and regulations under the act. Violations are only waste, however, and continued violations may result in prosecutions. The Outdoor Advertising Section plans strict adherence to its enforcement policies.

Advertisers are, in general, refraining from placing structures which might create traffic hazards. However, many continue to place signs which attempt to direct traffic, in violation of the Vehicle Code. As a guide to those interested in installation of displays containing directional data, types of permissible displays, and a facsimile of a print containing regulations, are shown in accompanying illustrations. Signs designed in accordance with the samples, properly installed, will conform to the provisions and regulations of the Outdoor Advertising Act and the Vehicle Code.

The existence of the Outdoor Advertising Act is generally known and its effectiveness is appreciated by those interested in highway construction and maintenance as well as by the pleasure motorist. The Outdoor Advertising Section with offices at Room 301, Public Works Building, 12th and N streets, Sacramento, California, and Room 805, State Building, Los Angeles, California, will gladly assist advertisers and others interested in administration of the act.

Will Advertise S. F. World's Fair

More than 2,500,000 California automobiles will carry the San Francisco World's Fair slogan on license plates in 1939, according to Governor Frank F. Merriam. With more automobiles registered than any other State or political subdivision in the world, California plans to make these plates an important factor in supporting the western States travel drive, which aims to make 1939 the greatest travel year in the history of the west. With a blue background and gold lettering, blue and gold being the exposition colors, the plates will carry the inscription on top: ''California World's Fair '39''.



Section of 20-foot Portland cement concrete pavement in Solano County near Vacaville.

CONSTRUCTION PROGRESS AND PAVEMENT RECORDS FOR 1937

By EARL WITHYCOMBE, Assistant Construction Engineer

STRENGTHENING of the foundation for the roadbed and pavement continued to be given primary consideration during the 1937 construction season in California. Results obtained with the various measures adopted in 1936 and continued throughout 1937 are exceptionally promising. The treatment of embankment foundations has in nearly every case proven successful in the severe test of the past winter, during which many failures occurred in older work.

Few locations within the State afford a native material throughout the entire length of the project which would be considered suitable for subgrade under our present standards, and selection of soils for the immediate subgrade is being practiced on nearly every pavement project. Wherever possible, suitable subgrade material is selected within the limits of the project, the only added expense involved being sometimes the additional haul.

Portland Cement Concrete

CONSTRUCTION METHODS

During 1937, the Johnson drag finisher was improved in design, and was used in finishing the project with the record smoothness for the season. This project has a reading of 3.5 inches per mile, which is but 43 per cent of the average for the year, and is the lowest average roughness of any pavement yet recorded since California adopted measures to rate surface smoothness.

The drag finisher consists primarily of a 20-foot frame from which are suspended two 18.5-foot lengths of floatboard crossed under the center of the machine. On three sides of the intersection are mounted V-sections of floatboard, two transverse and one longitudinal, with ready adjustments to the overhead frame. At the opposite end of the frame from the longitudinal V-section is mounted an 8″ roller. The drag finisher is reversible and is operated in both directions without turning. Ordinarily, six trips over the pavement are sufficient for finishing. The steel shod cut-float is used for the final finish and practically all of the cutting necessary consists of shaving off the material pushed up in the joint edging operations. The uniformity in surface smoothness on a concrete pavement finished by this method is quite remarkable.

GRAPHS OF PAVEMENTS

Through the courtesy of the Los Angeles County Road Department, graphs were taken of the surface obtained on typical pavements finished by the usual standard methods and by the use of the drag finisher. Their roughness measuring equipment records the variations of the middle point of a ten-foot length of pavement from a straight line between the two end points as shown by accompanying typical sections of the graphs.

Three trips are made over each pavement lane to indicate the roughness along the center line of the lane and along each quarter point line. The upper set of three readings shown in the illustration was taken on a project finished by standard methods with a roughometer reading of 8.4 inches per mile, and the lower set of three readings was taken on a section finished by the drag finisher with a roughometer reading of but 3.3 inches per mile.

Recent improvements in the construction of finishing machines has made the requirement of more than one machine unnecessary for maximum productions, and future specifications are being revised in this respect.

Joint construction and intervals between joints remain the same as heretofore with ½-inch width of premolded joint material at 60-foot intervals and weakened plane transverse joints at 20-foot intervals. No positive method has yet been perfected to hold the expansion joint filler normal to the pavement surface throughout the finishing operations. Constant vigilance is necessary to accomplish this result, and failure to observe these precautions results in early failure of the pavement in the immediate vicinity of the expansion joints.

(Continued on page 17)



Feather River Highway completed last summer boasts this excellent stretch of roadmix surface.



This is 42-foot plant mix surface on Marin County approach to the Golden Gate Bridge.

PORTLAND CEMENT CONCRETE PAVEMENT RECORDS FOR 1937

Location	Contractor	Resident Engineer	Street Assistant	Average cu. yds. laid per 8-hour day	Average strength, 28 days, lbs. per sq. inch	Per cent average daily variation in cement	Roughness index, inches per mile
Rocklin—Loomis	Basich Bros.	J. D. Greene	R. B. Vernon	423.7	4919	0.73	6.0
½ mi. W. of Soda Springs—Donner Summit	Fredericksen & Westbrook	W. G. Remington	H. S. Hart	422.6	4277	.91	11.0
Agnew Underpass—San Jose	A. J. Raisch & E. W. Heple	C. F. Price	F. D. Booth	346.2	3846	1.28	15.3
Bradley—6 mi. S. of San Ardo	Peninsula Paving Company	H. J. Doggart	S. N. Isham	326.7	4322	.43	8.5
Biola Junction—Herndon	Union Paving Company	F. W. Howard	R. M. Cooley	440.0	3708	.69	6.1
Belmont Circle—Biola Junction	Hanrahan Company	F. W. Howard	J. G. Sprague	365.2	4540	1.06	5.3
Fenwick St.—Terra Bella St.	C. O. Sparks & Mundo Engr. Co.	W. J. Calvin	E. C. Daniel	333.6	4602	.51	8.4
Monterey Park—Pomona	Griffith Company	R. J. Hatfield	F. L. Everitt	455.8	4740	.71	5.7
Playa St.—Washington Blvd.	J. E. Haddock	G. E. Farnsworth	G. H. Lamb	428.5	4784	.50	10.4
Atlantic Ave., 68th St.—Olive Street	United Concrete Pipe Corp.	F. B. Cressy	J. R. Rubey	304.0	5548	.65	12.9
Jct. of Whittier and San Gabriel Blvds.	J. E. Haddock	L. F. Phillips	G. H. Lamb	311.0	5264	.67	5.3
Center St.—Firestone Boulevard	Matich Bros.	F. B. Cressy	G. H. Lamb	429.8	4619	.28	5.4
Lakewood Blvd.—Norwalk Road	Sully-Miller Company	W. D. Eaton	F. L. Everitt	413.1	5443	.72	7.2
Norwalk—Miraflores	C. O. Sparks & Mundo Engr. Co.	E. A. Parker	H. D. Johnson	380.0	4133	.81	8.2
Firestone Blvd., through Downey	Sander Pearson	W. L. Welch	G. H. Lamb	326.7	4963	1.26	5.6
Hampshire Ave., Coast Blvd.—Garfield St.	J. E. Haddock	W. D. Eaton	H. D. Johnson	465.7	5813	1.54	3.5
Newport Beach—Laguna Beach	Geo. R. Curtis Co.	L. R. McNeely	H. D. Johnson	455.2	4669	.88	7.9
Center St.—Placentia Ave.	Oswald Bros.	F. B. Cressy	A. W. Carr	276.0	4334	1.10	5.2
Newbury Park—Conejo Creek	Mittry Bros.	W. I. Templeton	J. Fleharty	301.0	4452	.57	8.5
Colton—Waterman Avenue	Oswald Bros.	J. M. Hollister	B. Nelson	279.7	4180	1.47	8.3
1 mi. W. of Vacaville—0.7 mi. E.	Fredericksen & Westbrook	G. R. Hubbard	R. H. Lapp	411.8	3417	.65	13.3
Carquinez Bridge—0.9 mi. N.	Union Paving Co.	G. R. Hubbard	E. W. Ray	314.2	5438	1.09	17.9
El Cajon Ave., Texas St.—Euclid Ave.	Daley Corporation	W. T. Rhodes	E. C. Dodson	382.0	4618	.77	9.2
Las Flores Underpass—1 mi. S. of San Onofre	David H. Ryan	J. F. Taylor	F. Cimmino	456.7	4703	.42	7.7
Oceanside—Las Flores Underpass	Wood & Bevanda	L. H. Williams	L. B. Munro	350.9	4568	.83	9.1
			Averages	396.0	4470	.81	8.2

ASPHALT CONCRETE PAVEMENT RECORDS FOR 1937

Location	Contractor	Resident Engineer	Street Assistant	Average tonnage laid per day	Average stability of surface mixture in %	Average relative gravity of surface mixture in %	Roughometer index, inches per mile
Willows—Artois	N. M. Ball Sons	J. C. Womack	J. G. Mehren	745.6	42.7	91.3	8.2
Artois—Orland	Union Paving Company	J. P. Murphy	J. G. Mehren	723.2	35.6	92.2	10.0
San Jose—Coyote	Jones and King	C. F. Price	E. W. Herlinger	793.9	42.1	93.0	14.6
San Mateo—Redwood City	Basich Bros.	F. W. Montell	E. W. Herlinger	805.0	45.0	93.7	11.7
1 mi. N. of Rincon Creek—Carpinteria	Heafey-Moore Co.	J. C. Adams	F. C. Weigel	341.0	32.6	97.0	17.4
Miramar Ave.—Olive Mill Road	J. E. Haddock	J. C. Adams	S. N. Isham	371.6	42.5	95.9	13.0
Belmont Circle—Biola Junction	Hanrahan Company	F. W. Howard	H. Porter	543.0	32.5	93.5	13.1
Biola Junction—Herndon	Union Paving Company	F. W. Howard	E. Thomas	564.0	34.0	97.6	11.8
10.5 mi. S. of Bakersfield—Grove St.	Griffith Company	D. G. Evans	W. M. Nett	417.1	39.9	94.8	12.3
Marengo St., Cornwall St.—Lord St.	Oswald Bros.	C. N. Ainley	E. C. Daniel	483.2	35.0	95.2	10.3
Azusa—Claremont	Geo. R. Curtis Company	E. L. Seitz	W. E. Melcher	469.2	20.0	96.4	18.9
Fenwick Street—Terra Bella St.	C. O. Sparks & Mundo Engr. Co.	W. J. Calvin	E. C. Daniel	238.4	28.3	---	33.8
Wilmington Blvd.—Alameda Street	United Concrete Pipe Corp.	F. R. Pracht	A. W. Carr	612.0	38.4	95.3	15.0
Polyhi Court—Stanley Avenue	Sully-Miller Company	W. D. Eaton	A. W. Carr	535.4	34.3	94.2	19.6
Atlantic Blvd.—New Avenue	Geo. R. Curtis Company	C. P. Montgomery	A. W. Carr	510.0	40.0	94.9	12.0
Cerritos Ave., Firestone Blvd—Telegraph Ave.	Geo. R. Curtis Company	W. F. Axtman	W. E. Melcher	464.3	33.4	95.1	14.0
Norwalk—Miraflores	C. O. Sparks & Mundo Engr. Co.	E. A. Parker	A. W. Carr	472.5	33.3	94.7	18.3
Newbury Park—Conejo Creek	Mittry Bros.	W. I. Templeton	A. W. Carr	269.1	41.0	91.6	22.7
Pyle Road—Telegraph Road	Griffith Company	W. I. Templeton	W. A. Norman	488.7	37.0	95.8	12.9
Camarillo State Hospital	Griffith Company	W. I. Templeton	W. A. Norman	277.0	40.0	---	86.3
Colton—Waterman Ave.	Oswald Bros.	J. M. Hollister	W. Ford	352.1	33.0	---	20.6
Del Mar—Encinitas	Griffith Company	R. C. Payne	L. E. Crayne	529.2	30.6	96.0	25.0
Oceanside—Las Flores Underpass	Wood and Bevanda	L. H. Williams	L. B. Munro	513.3	44.8	92.8	12.4
Main St., Division St.—32nd St.	V. R. Dennis Company	F. D. Pearce	M. H. West	368.1	43.4	96.0	30.1
			Averages	550.0	36.0	94.6	15.5

BITUMINOUS TREATED SURFACES, RECORDS FOR 1937

Location	Contractor	Resident Engineer	Roughness inches per mile
Plant Mix			
Sapp Creek—Pepperwood School	Hemstreet & Bell	D. J. Stout	18.5
Beatrice Overhead Crossing—Eureka	Hemstreet & Bell	H. C. Amesbury	20.5
1.4 mi. W. of Hot Creek—Alturas	Hanrahan Company	M. Fredericksen	18.8
Route 3—1.5 mi. E. of Dales	A. Teichert & Son	J. C. Young	28.9
Shasta—Redding	D. McDonald	H. K. Ward	30.0
Westwood—Coppervale	Union Paving Company	C. A. Potter	73.4
Donner Grade—E. end Donner Lake	Pacific States Const. Co.	J. W. Corvin	39.6
Waldo Point—Golden Gate Bridge	Macco Construction Company	H. S. Payson	25.5
Broadway Tunnel—2 mi. W. of LaFayette	Granfield, Farrar & Carlin	W. A. Rice	49.6
Camelia St.—San Pablo Avenue	Union Paving Company	L. G. Marshall	23.4
2 mi. W. of LaFayette—Walnut Creek	Union Paving Company	W. A. Rice	42.5
1.2 mi. E.—3.0 mi. E. of Petaluma	Peter J. McHugh	E. Carlstad	13.9
¼ mi. S. of Strathmore—Valencia St., Eastwood Ave.—Cairns Corner	N. M. Ball Sons & Larsen Bros.	C. F. Oliphant	33.0
Calabasas School—Brent Jct.	C. O. Sparks & Mundo Engr. Co.	W. J. Calvin	40.4
Azusa Ave.—San Gabriel River Bridge	A. S. Vinnell Company	C. R. Montgomery	13.0
Center Street—Firestone Blvd.	Matich Bros.	F. B. Cressy	15.7
Lakewood Blvd.—Norwalk Road	Sully-Miller Co.	W. D. Eaton	31.7
Carolina Ave.—Yorba Linda	C. O. Sparks & Mundo Engr. Co.	H. J. Fallai	26.3
Dowling Ave.—Linda Vista Street	A. S. Vinnell Company	L. B. Lindley	23.7
Newbury Park—Conejo Creek	Mittry Bros.	W. I. Templeton	32.7
At Snow Creek	Oswald Bros.	E. A. Bannister	29.5
Beaumont—2 mi. westerly	Oswald Bros.	J. M. Hollister	17.1
Carquinez Bridge—0.9 mi. northerly	Union Paving Company	G. R. Hubbard	74.4
Los Banos—10.5 mi. easterly	Louis Biasotti & C. C. Wood	A. K. Nulty	20.4
Sandia—Alamo River	George Ellis	J. F. Taylor	20.8
Calexico—3.1 mi. easterly	R. E. Hazard & Sons	C. R. Hagbert	20.2
Lake Hodges—Escondido	R. E. Hazard & Sons	L. E. Liston	7.5
Harasthy Street—Barnett Street	V. R. Dennis Co.	B. F. Moore	78.0
Oceanside—Las Flores Underpass (por.)	Wood and Bevanda	L. H. Williams	24.1
		Average	28.6
Road Mix			
Trinidad—McNeil's Ranch	Poulos and McEwen	E. L. Miller	35.7
Howell—¼ mi. S. Keddie	Hayward Bldg. Material Co.	C. Brown	19.8
Sulphur Creek—Boulder Creek Hill	Guy F. Atkinson Company	P. F. Green	35.4
Viola—Forest Boundary	Fredericksen & Westbrook	G. Sundman	35.0
Farallone City—Rockaway Beach	Granfield, Farrar & Carlin	H. A. Simard	12.6
Route 68—N. City limits of San Jose	Basich Bros.	C. F. Price	34.4
Agnew Underpass—San Jose (por.)	Raisch & Heple	C. F. Price	51.2
2½ mi. E.—3¼ mi. E. of Monolith	Young and Son	D. G. Evans	33.3
Box Springs—3 mi. E. of Moreno	Oswald Bros.	E. A. Bannister	16.8
Mountain Pass—Nevada State Line	Geo. Pollock Company	C. V. Kane	57.5
2.5 mi. W. of Java—0.5 mi. E. of Java	Basich Bros.	G. E. Malkson	33.5
Between Amboy and 17 mi. E. (por.)	Basich Bros.	G. E. Malkson	36.9
Conway Summit—1 mi. W. of Bodie Road	Isbell Construction Co.	J. N. Stanley	12.8
4 mi. S.—1.7 mi. S. of Fish Springs	Basich Bros.	M. W. Ellis	45.4
Bishop—Owens River	Basich Bros.	R. E. Raley	41.9
Near Inyokern	Basich Bros.	R. V. Murray	46.5
1.2 mi. SE.—1.7 mi. NW. of Rodemacher	Basich Bros.	R. V. Murray	28.7
Mammoth Lake—Route 23, Casa Diablo Hot Springs	Oswald Bros.	F. R. Pracht	23.7
Vernalis—Gates Road	Basich Bros.	A. N. Lund	15.3
Stoddard Springs—McCoy Saddle	Beerman, Jones & Maestretti	E. W. Ray	39.2
Mulberry Avenue—Calipatria	R. E. Hazard & Sons	J. F. Taylor	34.2
2.5 mi. E. of Rincon—Rancho Cuca	R. E. Hazard & Sons	I. W. Littlefield	34.5
		Average	31.6
Miscellaneous Types			
Menlo Country Club—Woodside	Union Paving Co.	A. Walsh	161.8
Waldo Point—Golden Gate Bridge	E. A. Forde	W. A. Rice	28.3
Spence Street—Downey Road	C. F. Robbins	A. W. Hoy	72.6
		Average	65.7

(Continued from page 15)

Construction Records

One outstanding project holds the record for 1937 for maximum average daily output, strength of concrete, and surface smoothness. Contract 07XC3, road VII-Ora-171-A, Hnt B, on Hampshire Avenue between Coast Boulevard and Garfield Street, established an average output of 465.7 cubic yards of concrete per day, an average compressive strength of 5813 pounds per square inch, and an all-time record was made on surface smoothness

(Continued on page 24)

Highway Between Redlands and Crystal Springs to Be Realigned

By A. EVERETT SMITH, Assistant Highway Engineer

IN LINE with recent improvements on State Highway Route 26, a project will soon be under way from New Avenue in Redlands easterly to Crystal Springs, a distance of two and thirty-six one-hundredths of a mile. Bids were opened for this project on April 21. Claude Fisher submitted the low bid. This is a link in the Los Angeles to Imperial Valley highway.

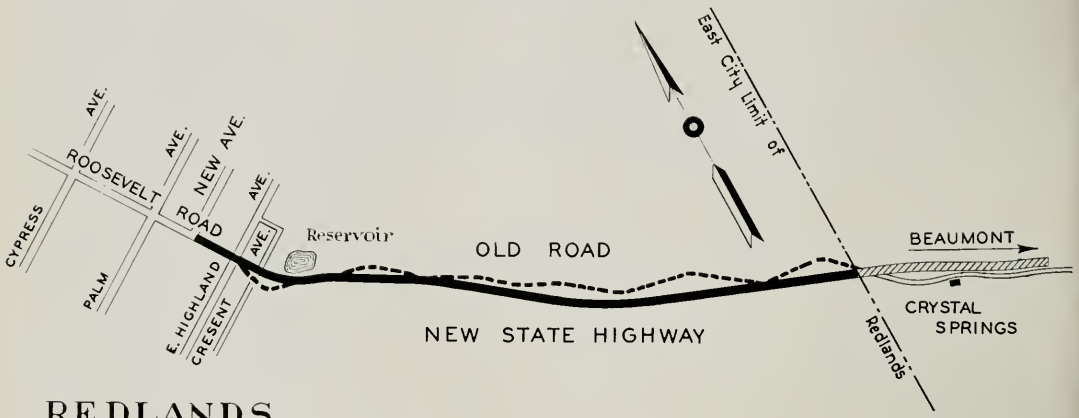
The project beginning at New Avenue extends easterly through Reservoir Canyon, and continues on up Crystal Springs Canyon to Crystal Springs. This is an especially delightful portion of highway. It is here that the west bound traveler leaves the desert roads behind and suddenly finds himself swinging down the pleasant Crystal Springs Canyon. A little farther and he has passed the Redlands City Reservoir and immediately, without previous warning, is in the midst of fragrant orange groves.

NEW ALIGNMENT

From New Avenue to Highland Avenue, some seven hundred feet, the new construction will follow the existing traveled way along Roosevelt Road. From Highland Avenue to the eastern terminus, new alignment will be used throughout. Along the west end of the project, for the convenience of public traffic, a detour will be constructed and surfaced with road mix surface treatment. Along the balance of the work, traffic will be permitted to use the existing road during construction.

From the beginning of the project to the east city limits of Redlands, approximately four thousand, four hundred cubic yards of Class "B" Portland cement concrete will be used in constructing two lanes of pavement, each eleven feet in width and approximately one and eight-tenths miles in length. This pavement is to be bordered with road-mix surface treated shoulders to a minimum width of eight feet on each side.

Most of the material for roadway embankment will be obtained from the portion of the project that lies east of Redlands city limits. This portion will be graded to rough grade only at this time. It is, however, designed to modern standards of alignment and will eventually be used to eliminate the sharper curves in the Crystal Springs Canyon. Approximately ninety-four thousand cubic yards of roadway excavation is to be moved, involving some five million station yards of overhaul.



THIRTY-EIGHT FOOT ROADBED

Facilities for adequate drainage will be supplied by placing corrugated metal pipes, and reinforced concrete box culverts.

The highway is to be constructed in general to a thirty-eight foot roadbed width, so designed as to be suitable for ultimate use as a one-half section of a four lane highway with a central dividing strip.

When complete, this new highway will present a two lane pavement with wide surfaced shoulders, all constructed to modern standards. The alignment will be greatly improved and will have a minimum radius of curvature of one thousand feet.

Proposed improvement of East approach to Redlands. Dotted lines show new alignment through valley below Crystal Springs.

The new highway will replace an old bituminous macadam pavement that is very rough and is fast giving way under the heavy automobile and truck traffic to which it is subjected. The old road has numerous sharp curves with inadequate sight distances, making driving slow and hazardous. Here, as was the case on other sections of this route before improvement, the lighter and faster vehicles form long lines of traffic behind the big slow moving trucks where sight distance, due to outmoded alignment, is inadequate for safe passing. This improvement will greatly facilitate traffic movement and will eliminate another section on this route where this particular type of difficulty has been encountered to a serious extent.

Proposed project at the east entrance to Redlands. Dotted lines show new alignment eliminating steep and dangerous curves.



STATE SURVEYS ITS SNOW CROP

By FRED H. PAGET, Associate Hydraulic Engineer

SNOW surveys are conducted annually by the Division of Water Resources to gage the area, depth and density of the California snowpack. From this snowpack will come the water necessary during the following summer for crop irrigation, power generation, mining, manufacturing and municipal needs; as well as for navigation requirements, salinity prevention, and a multiplicity of smaller uses.

While man can not regulate or control the release of water stored in the mountain snowpack, he can, if he knows the amount that will be at his disposal, arrange ahead of time an intelligent program to get the full benefit of this water as it is released by the forces of nature. It is to get this advance knowledge that the snow surveyors each spring trek into the snow covered mountains to measure and gage the snow crop.

HEAVY SNOW PACK

Few people fully appreciate the immensity of the water storage capacity provided by the snow fields which reach from the Tehachapi on the south to Mount Shasta on the north, covering an area of approximately 17,000 square miles, as the rainy season in California closes and the irrigation season begins.

On April 1st of this year some 33 million acre feet of water were held stored in the Sierra snowpack as compared to 4 million acre feet total storage in the man-made reservoirs of this same region. Outranking many times in volume the man controlled water supply and even more advantageously placed as regards distribution and elevation, it is extremely important to have an accurate measurement made annually of this most valuable water crop.

Since 1929 the California Cooperative Snow Surveys have been in operation. Each year many organizations, including private corporations, public utilities, municipalities, irrigation, water storage, and municipal districts, as well as governmental agencies—State and Federal—unite under the leadership of the Division of Water Resources to make the annual measurements.

NETWORK OF SNOW COURSES

During the summer months, under the guidance of the Division, the necessary preparatory work is done. New snow courses are laid out and old ones cleared of encroaching brush and young trees; the use of existing cabins is arranged for or new ones built, while snow measuring equipment in each area is put in good shape and new men are instructed as to its use.

A network of snow courses covers each watershed, each snow course representing a surrounding area varying in extent according to topographic conditions. The snow course as a rule is laid out in the shape of a cross large enough to allow of about 20 samples being made at 50-foot intervals, both ends of each line being permanently marked with a yellow and red snow course marker spiked to a convenient tree, high enough to be above the deepest snow of a severe winter.

TAKING OF SAMPLES

A sketch map showing the location of the sampling points with relation to the markers is carried by each snow survey party. At each sampling point shown on the map a measurement must be made. Using a hollow steel or aluminum tube with sharp teeth along the lower cutting edge a sample is cut from the snowpack, from the surface to the ground beneath, in much the same manner as an apple is cored. The depth of the snow is noted from graduations on the outside of the tube and then the tube with its core of snow is withdrawn and weighed on special spring scales so calibrated that the amount of water in the snow is indicated directly by the reading of the scales. An average of the twenty samples taken at each snow course irons out any inequalities due to uneven ground or drifted snow.

The snow surveyors, men of sound physique and stout heart, travel from 10 to 30 miles a day, depending upon their schedule, the condition of the weather and the state of the snow. Shelter cabins for stops and emergencies as a rule are available at 12-mile intervals. These are equipped with a bed, a stove and a table, and stocked ahead of time with fuel, food and bedding.

SOME HARDSHIPS

Primitive though the comforts of the shelter cabins are, they are much to be preferred to a night in the open such as was the unhappy lot of two of our snow surveyors who last year lost their way in the gloom of an early evening snow storm. Jammed together into their one sleeping bag in a shallow depression in the snow, sheltered by a clump of pine trees they holed up to wait for dawn. Fortunately the weather was not extremely cold and beyond having to put up with rather cramped quarters, a mild pang of hunger or two, and the difficulty of getting their feet back into frozen boots excavated from under a foot of freshly fallen snow, they came through in good shape.

Backtracking after daylight they found where they had missed the turnoff and an hour later they were enjoying a good hot breakfast in the shelter cabin they should have reached the evening before.

This year 150 men took part in the main survey of the snowpack. On skis or webbed snow shoes according to their personal choice, those parties entrusted with the longer trips into the more isolated regions started out on March 23d, and the last man reported back on April 8th.

BEAR STEALS GRUB

The routine reports of their trips included delays on account of storms, snow blindness and equipment trouble. Cabins in some instances were crushed in by the unusually heavy snow. Grub caches rifled by unscrupulous hunters were reported, and in the Kern River watershed a bear, with a hunger for fattening food, clawed his way through one end of a shelter cabin, and after devouring most of the grub supply and spoiling the rest, forced his way out through the other end. The snow had flattened the weakened

(Continued on page 24)





1. Taking snow sample. Tube is held vertically and started down at position indicated on sketch map of snow course.

2. With weight applied to driving wrench the tube is rotated and forced down through snow to ground below.

3. Tube with its snow core is weighed to determine water content of snow.

4. Snow measurements completed, survey crew starts for home as storm begins.







Before and after pictures of secondary highways in Imperial County. These views show sections of the same roads prior to improvement and following regrading and surfacing.

Secondary Improvem

By W. L. McFADDE

IN 1933 the Legislature added to the State Highway System, one hundred sixty-seven miles of secondary roads in Imperial County. Of this mileage only seventy-four miles had been previously surfaced, and the existing surfacing was generally, at that time, badly in need of repair, or abandonment and realignment. The remaining ninety-three miles were unsurfaced, and were made passable by flooding alternate sections to overcome the dust and ruts.

The natural material, with the proper amount of moisture, made a fair road for light travel, but was not suitable for heavy truck hauling, and when dry, was very dusty. After even a slight rainfall, such as the valley experiences, it was necessary to use tractors to tow wagons and trucks on all unsurfaced roads.

FARM TO MARKET ROADS

This was the existing condition of the major portion of these roads when taken into the State Highway System five years ago. In order to properly serve the increasing traffic load of these secondary highways, which are chiefly farm-to-market roads, and upon which the agricultural areas depend for communication and transportation, the Division of Highways has set up a stage construction program

The program consisted of constructing, as soon as possible, with the funds available, low cost bituminous type surfaced roads. This construction consists of bringing the roads to proper grade and alignment, improving the base by importing suitable material, the repair of irrigation facilities to prevent their damaging the roadbed with moisture in the future, and surfacing the roadbed with plant or road mix bituminous treated gravel.

While this type of construction can not be expected to carry the heavy truck traffic for any length of time without high maintenance costs, it will probably serve its purpose until

Highway
nt

ssociate Highway Engineer

funds are available to construct the higher types of pavement, and will at that time serve as a suitable base which is essential because of the unstable soil conditions encountered in the valley.

CONSTRUCTION PROBLEMS

It has been possible to improve the secondary system in the Imperial Valley to its present stage only by utilizing, to the fullest extent, the local materials available. Adverse soil conditions, seepage water from adjacent irrigation facilities and the long distances from the source of supply of the ordinary road construction materials, have been some of the problems to meet and overcome with the limited funds available for road construction. Nearly all of the aggregate used in the oiled surfacing, and for improving the base on which the surfacing is placed, has come from the ancient beach line which parallels the valley on the east.

The completion, the latter part of January, of the improvement on the four miles between Brawley and Calipatria, provides a dustless and mudless surface on the entire State Highway System in the valley.

THIRTEEN MAJOR HIGHWAYS

Since 1933, the Department of Public Works, through the Division of Highways, has completed thirteen major projects, expending a total sum of approximately $785,700, in the improvement of one hundred twenty-eight miles of highway. The average cost per mile has been approximately $6,200.

Recent traffic counts have shown that travel on some of these roads that have been improved, has increased from one hundred to one thousand cars per day. This increase indicates the advantage to the valley traffic of such improvement, and additional surfacing or paving will be added as required in order to properly provide for the traffic.



Hard to believe, but true. Views of old and new secondary highway in Imperial County.

Bay Bridge Traffic Increases

AN INCREASE in daily traffic on the San Francisco-Oakland Bay Bridge of 1,523 cars over the previous month was announced by State Director of Public Works Earl Lee Kelly from a report of April traffic figures for the span, filed by State Highway Engineer C. H. Purcell. During last month 23,118 vehicles per day crossed the bridge.

Total number of vehicles for April was 693,547 as against 669,431 vehicles for March. Total collections for April were $367,996.88, as compared to March figures of $348,235.23.

Comparative figures and totals follow:

	Total April	Total March	Total since opening
Passenger Autos	645,603	617,244	12,383,228
Auto Trailers	892	595	20,165
Motorcycles	2,247	1,895	44,073
Tricars	1,077	1,061	12,883
Trucks	31,719	36,878	442,924
Truck Trailers	1,244	1,172	26,634
Buses	10,765	10,586	144,491
Total Vehicles	693,547	669,431	13,074,398
Extra Passengers	188,120	166,045	2,897,624
Freight Lbs.	74,814,670	68,607,331	1,001,537,020

State Surveys Its Snow Crop

(Continued from page 20)

cabin to earth by the time the boys arrived and the blankets were a mass of ice. Tired as they were there was nothing else to do but take up a few notches in their belts and slog on twelve miles more to the next cabin.

At Sacramento the snow survey reports are segregated as to watersheds and by a systematic procedure the snowpack in each watershed is appraised and forecasts of run-off are made. During the past few years most of the forecasts have had an accuracy of better than 10 per cent while many are much closer than that figure.

For the Sierra as a whole this year's snowpack is well above normal and in most watersheds heavier than any measured during the nine years that snow surveys have been made. A tabulation of all the snow survey measurements together with forecasts of flow from 14 watersheds are contained in the Snow Survey Bulletin issued by the Division of Water Resources on April 11th. Copies of this bulletin may be had from the Division upon request.

Motorways Plan for South

The 1937 traffic survey of the Los Angeles metropolitan area made by the Automobile Club of Southern California presented as the logical solution to Los Angeles County's acute congestion and accident problems, proposes a network of new intersection-free divided motorways exclusively for motor vehicles across the metropolitan area. These would continue on upper story levels through specially designed parking and office buildings in business districts, and on bridges across existing streets.

Other recommendations include prohibiting curb parking on all commercial streets and highways and developing off-street parking facilities, restricting curb parking on residential streets, removing all street railways within a reasonable period of time, establishing an adequate motor bus system with off street terminals, and separating grades of commercial street intersections wherever practical.

PAVEMENT RECORDS

(Continued from page 17)

of 3.5 inches per mile, with the use of the Johnson drag finisher. J. E. Haddock, Ltd., was the contractor, W. D. Eaton, the resident engineer, and H. D. Johnson, street assistant. It is indicated on later work that the Johnson drag finisher is capable of producing a surface smoothness superior to that produced on this project.

The average daily concrete pavement output for the entire State during 1937 was 396 cu. yds., compared to 386 cu. yds. in 1936. The average compressive strength for Class "A" concrete pavement laid during 1937 was 4470 pounds per square inch, as against 4550 pounds in 1936. On Contract 610TC10, road X-Sol-7-C,Vac.D, Class "B" concrete was placed, having a strength of 3417 pounds.

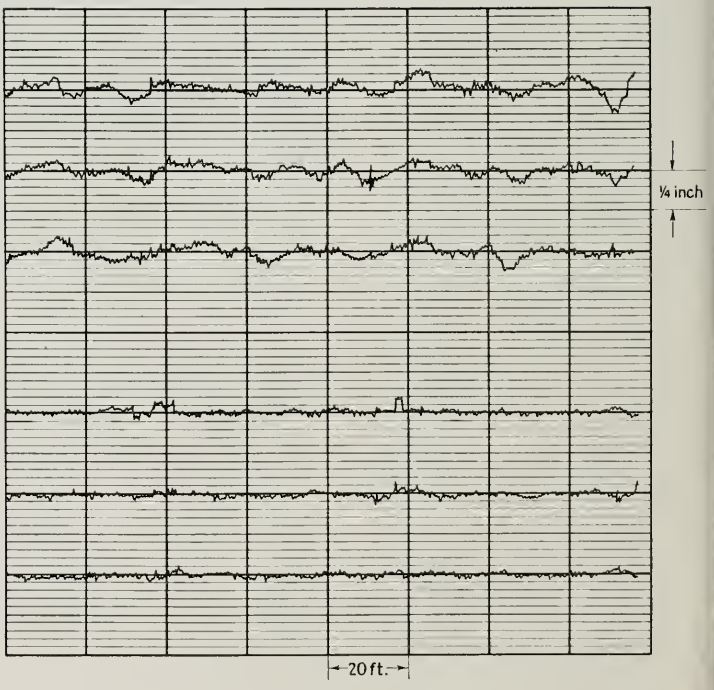
The average surface smoothness for the State during 1937 was 8.2 inches per mile compared to 12.1 inches in 1936.

The record for cement control was made on Contract 87XC25, road VII-L.A-168-A,B, Center Street to Firestone Boulevard, with an average variation of 0.28 per cent. Matich Bros. were the contractors, F. B. Cressy, resident engineer, and G. H. Lamb, street assistant. The average variation in cement control for 1937 was 0.81%, compared to 0.85% in 1936.

Asphalt Concrete

CONSTRUCTION METHODS

During the 1937 season, an experimental section was constructed on Contract 66VC5-86VMC1, road VI-Ker-4-C,Bkd, from 10.5 miles south of Bakersfield to Grove Street, using asphaltic cement of a much higher



GRAPHS OBTAINED BY LOS ANGELES COUNTY ROAD DEPARTMENT



Example of 20-foot asphalt concrete lane with concrete curbs and earth dividing strip in Montecito, Santa Barbara County.

penetration than the usual standard of 40 to 60. 2540 lineal feet of surface was laid with 70 to 80 penetration asphalt, 2350 lineal feet with 110 penetration, 2635 lineal feet with 160 penetratioin and 3910 lineal feet with 90-95 road oil.

It was necessary to revise the rolling procedure on the sections in which the softer grades of asphalt were used, but this did not materially complicate construction methods, and the surface smoothness of the experimental sections compares favorably with the standard sections.

Since the use of asphaltic cement of higher penetrations is increasingly evident in asphalt concrete pavement construction, the department is adopting ranges of 71 to 85, 86 to 100, and 101 to 120 penetration, for future work.

Compensation in the asphalt content is being made for the asphaltenes as indicated in the petroleum ether solubility test, and this correction has resulted in a uniformity in mixtures that was impossible to obtain under former methods. These corrections will be continued with the softer grades of asphalt.

Construction Records

The **maximum daily output** of asphalt concrete, and the **highest average stability** of surface course mixtures were obtained on Contract 84TC13-64TC32, road 1V-S.M-2-S. M,Bmt,B,S.Car,Rdw.C, from San Mateo to Redwood City. An average of 805 tons of asphalt concrete were laid per eight-hour day, and the average stability of surface course mixtures was 45%. Basich Bros. were the contractors, F. W. Montell the resident engineer, and E. W. Herlinger, the street assistant. The average daily output for the State during 1937 was 550 tons, compared to 447 tons in 1936. The average stability of surface mixture was 36% during 1937.

The **densest surface mixture** was placed on Contract 86TC4, road VI-Fre-4-C, Biola Junction to Herndon, in which the average relative specific gravity was 97.6%. Union Paving Company was the contractor, F. W. Howard, the resident engineer, and E. Thomas, the street assistant. The State average was 94.6%, compared to 94.3% in 1936.

The record for **surface smoothness** was secured on Contract 03TC1, road 111-Gle-7-B, Willows to Artois, in which the average roughness was 8.2 inches per mile. N. M. Ball Sons were the contractors, J. C. Womack the resident engineer, and J. G. Mehren, the street assistant. The average smoothness for the State was 15.5 inches as compared to 14.7 inches per mile in 1936.

A slightly greater mileage of plant-mix surface was laid in 1937 than in previous years, there having been constructed 120 miles of this type

(Continued on page 28)

AN APPRECIATION

Dept. of Public Works,
Sacramento, Calif.

Attention Superintendent;
Highway Maintenance Service:

It is with great pleasure that I compliment you for the marvelous work you have done for the motorists of this State and the training of your personnel.

To prove the above statement, this day about 100 yds. west of the west terminal of the Broadway Tunnel, my automobile caught fire. It was only through the help of one of your courteous maintenance men, Mr. J. A. Peirano, that my car was saved from a total loss.

I tried to compensate Mr. Peirano for his service but he flatly refused to accept.

If all organizations had their men trained to be as obliging as you have, wouldn't we be living in a better world?

A Most Grateful Motorist,

Sincerely,

AVARON DAVIS
1535 Scenic Ave.,
Berkeley, Calif.



ENGINEERING studies for negotiations and contracts in connection with the construction and operation of the Central Valley Project have been continued by the Division of Water Resources, representing the Water Project Authority of the State of California, under a cooperative work agreement with the U. S. Bureau of Reclamation.

During the month studies were made of the general plans for the Shasta Dam and Miles 4 to 12 of the Contra Costa Canal and approval of these plans was given by the Water Project Authority.

The Bureau of Reclamation opened bids on April 11 for a diversion tunnel and temporary relocation of the Southern Pacific Railroad at the Shasta dam site. Announcement has also been made by the Bureau that bids for another eight miles of the Contra Costa Canal will be opened on May 20 and that the bids for the construction of the Shasta Dam will be opened on June 1.

Work has continued and good progress is being made on the construction of the Contra Costa Canal and the Government Camp for Shasta Dam. The first four miles of the canal are more than 65% completed and the buildings for the Government Camp are practically completed.

IRRIGATION DISTRICTS

Late storms and high water conditions have delayed somewhat the opening of the irrigation season, but in many of the districts water has been turned into the canals. The heavy snow pack in the mountains assures an ample supply of water for most areas during the coming summer. Seepage and high ground water have given some trouble in the cultivation and planting of crops and plans for supplemental drainage are being investigated in certain districts.

SUPERVISION OF DAMS

Two applications were received during April, namely for Fairmount Park Dam in Riverside County and McCarty Dam in Calaveras County. Within the month Bonita Canyon Dam in Orange County, Gene Wash Dam in San Bernardino County and O'Shaughnessy Dam in Tuolumne County have been completed and will be ready for approval at an early date. There has been satisfactory progress made on the work at Bean Hollow Dam in San Mateo County and North Fork Dam in Santa Clara County, and the work at Copper Basin Dam in San Bernardino County is very nearly completed.

WATER RIGHTS

Supervision of Appropriation of Water

Seventeen applications to appropriate water were received during March, 6 applications were denied and 8 applications were approved. In the same period 4 permits were revoked and the rights under 6 permits were confirmed by the issuance of licenses.

Field work for the year 1938 involving the investigation of projects under permits and licenses began on April 11th. There are 288 cases listed for investigation as compared with 233 last year and 259 in 1936. Visits will be necessary to all except 5 counties of the State.

SACRAMENTO-SAN JOAQUIN WATER SUPERVISION

Field work has commenced and at present consists of visiting all points of diversion to insure that records of operations will be kept during the coming season. Discharge measurements are being made of the larger plants which are at present in operation. Due to the abnormally heavy rainfall during the past winter, it will be some time before all of the smaller plants along the rivers are in operation.

CALIFORNIA COOPERATIVE SNOW SURVEYS

During the last week of March and the first week of April, the main annual snow survey was conducted throughout the Sierra from the Klamath to the Kern.

Engaged on this work were 150 men who took part in the survey, working from 40 centers strategically located to give access to the entire area with a minimum of travel.

FLOOD CONTROL AND RECLAMATION

Maintenance of Sacramento Flood Control Project

During this period there were no extremely high stages in the channels of the flood control project, but during the entire interval the stages remained relatively high for this time of the year, and for most of the period they remained above bank full stage. As a result of this extremely unusual condition, excessive seepage is causing damage to land bordering the Sacramento and Feather Rivers, particularly to the orchards. The drainage plants of the Sutter By-pass were operated continuously throughout the month and miscellaneous maintenance work has been carried on. Water has been spilling into the by-passes through Colusa, Tisdale and Fremont weirs during practically the entire period.

Relief Labor Work

During this period about 50 relief laborers have been employed in clearing the right-of-way for State-Federal levee construction on the left bank of the Sacramento River from Meridian to Butte Slough. About 25 WPA men have been engaged in miscellaneous work on other parts of the project. All by-pass and overflow channels have been covered with water so that clearing with relief labor could not proceed.

Sacramento Flood Control Project

Construction has been completed on five timber bridges in the Dry Creek project near Wheatland.

Emergency Levee Repairs

Work has been continued in making repairs to levees in Glenn, Shasta, Butte and Tehama Counties under Executive Order No. E 177, and at this date approximately $75,000 has been expended. In early April it was found necessary to do some further work at Robinson Bend on the Feather River, due to the excessive bank erosion at low water stage. A set-back levee was constructed 1400 feet long, and about 2000 tons of Oroville cobbles were used to protect the bank.

Emergency Levee Protection and Repair

The levee breaks on the Paradise Cut in San Joaquin County have been closed and all emergency protection work on the San Joaquin River in San Joaquin County has been discontinued, except at a point downstream from the Banta-Carbona Irrigation District intake. Bank erosion is continuing at this place in a manner which may endanger the levee during the rise expected from the melting snows.

Highway Bids and Awards for the Month of April, 1938

ALAMEDA COUNTY—East approach to the San Francisco-Oakland Bay Bridge between the distribution structure and University Avenue, about 3.3 miles redwood curbs to be constructed, a water supply line installed and shoulder widening and parking areas to be constructed and a penetration oil treatment applied thereto. District IV, Route 5.69, Section Oak., Emv., Ber. Underground Construction Co., Oakland, $24,833; L. C. Seidel, Oakland, $25,848; Lee J. Immel, Berkeley, $25,429; M. J. Lynch, San Francisco, $28,023; Chas. L. Harney, San Francisco, $32,116; A. Soda and Son, Oakland, $30,392; Eaton & Smith, San Francisco, $33,822. Contract awarded to Williams Bros. & Haas, Inc., San Francisco, $23,642.18.

GLENN COUNTY—Elk Creek Road, between 7 miles wast of Willows and 10.5 miles west of Willows, about 3.5 miles to be surfaced with gravel base and road-mix surfacing and shoulders to be constructed. District III, Feeder road. Claude C. Wood, Stockton, $17,448; E. A. Forde, San Anselmo, $17,996; N. M. Ball and Sons, Berkeley, $18,471; Poulos and McEwen, Sacramento, $18,834; Oilfields Trucking Co., Bakersfield, $19,259; Fredericksen & Westbrook, Lower Lake, $19,544; Harms Bros., Susanville, $19,634; C. W. Calletti & Co., San Rafael, $21,746; Helwig Construction Co., Sebastopol, $22,382; Hanrahan Co., San Francisco, $22,518; E. B. Bishop, Orland, $23,446. Contract awarded to Lee J. Immel, Berkeley, $17,411.00

IMPERIAL COUNTY—Furnishing and spreading gravel between four miles east of Imperial and 1 mile east of Brawley. District XI, Route 201, Section B. V. R. Denis Construction, San Diego, $17,257; G. W. Ellis, Los Angeles, $12,471. Contract awarded to R. E. Hazard & Sons, San Diego, $10,983.90

INYO COUNTY—At Independence, about 1.5 mile to be graded and roadmix surfacing applied. District IX, Route 23, Sections M, A. Vido Kovacevich, South Gate, $19,792. Contract awarded to Basich Bros., Torrance, $19,677.10.

KERN COUNTY—Between southerly boundary and 5 miles north of Rosamond, about 8.3 miles to be graded and plant-mixed surfacing to be placed. District IX, Route 23, Section A. V. R. Dennis Construction Co., San Diego, $59,912; Claude Fisher Company, Ltd., Los Angeles, $64,893; Basich Brothers, Torrance, $64,922; Griffith Company, Los Angeles, $65,150; R. E. Hazard & Sons, San Diego, $66,129; Gibbons & Reed Co., Burbank, $67,910; George R. Curtis Paving Co., Los Angeles, $70,892; Piazza and Huntley, San Jose, $71,871; Hanrahan Company, San Francisco, $91,180; L. A. Paving Co., Los Angeles, $119,772. Contract awarded to G. W. Ellis, North Hollywood, $54,294.80.

LASSEN COUNTY—Between Nuhieber and 8½ miles northeast of Bieber, about 10.4 miles to be graded and surfaced with plant mixed surfacing. District II, Route 28, Sections A, B. J. A. Casson, Hayward, $116,055; Larsen Bros. and Harms Bros., Sacramento, $134,835; Hanrahan Co., San Francisco, $151,989; Pacific States Construction Co., San Francisco, $157,943; Union Paving Co., San Francisco, $162,391; Claude C. Wood, Stockton, $127,817. Contract awarded to Poulos and McEwen, Sacramento, $106,534.90.

LOS ANGELES COUNTY—Undergrade crossing under tracks of S.P.R.R. near Hewitt Station and approaches to be constructed. District VII, Route 159, Section L.A. C. O. Sparks and Mundo Engineering Co., Los Angeles, $184,986; Gibbons & Reed Co., Burbank, $175,452; Claude Fisher Co., Ltd., Los Angeles, $180,909; L. A. Paving Co., Los Angeles, $198,618; Griffith Co., Los Angeles, $190,493; Byerts & Dunn, Los Angeles, $172,166; Winston Bros. Co., Los Angeles, $188,247; Gates & Huntley, Los Angeles, $215,431; John Strona, Pomona, $169,890; United Concrete Pipe Corp., Los Angeles, $183,057; Minnis and Moody and Werner and Webb, Los Angeles, $179,741; J. E. Haddock, Ltd., Pasadena, $181,415. Contract awarded to Oscar Oberg, Los Angeles, $165,732.25.

MENDOCINO COUNTY—Between Henry Gulch and Westport Gulch, about 1.3 miles to be graded and penetration oil treatment applied. District 1, Route 56, Sections A,B,C,D,F. Harold Smith, St. Helena, $31,506; Chas. L. Harney, San Francisco, $32,432; John Burman and Sons, Eureka, $34,265; Valley Construction Co., San Jose, $35,719; F. J. Maurer & Son, Inc., Eureka, $35,764; Guerin Bros., San Francisco, $38,443; Claude C. Wood, Stockton,$41,483; Lee J. Immel, Berkeley, $44,985; C. W. Calletti & Co., San Rafael, $48,122. Contract awarded to Rock & Gravel Trucking Co., Oakland, $28,449.90.

MENDOCINO COUNTY—Between ½ mile north of McCoy Creek and Piercy, about 1.5 miles to be graded and surfaced with untreated crushed gravel or stone surfacing. District I, Route 1, Section K. C. W. Caletti & Co., San Rafael, $89,788; Chas. L. Harney, San Francisco, $89,536; Young & Son Co., Ltd., Berkeley, $91,411; N. M. Ball Sons, Berkeley, $94,839; Hemstreet and Bell, Marysville, $97,255; Fredericksen and Westbrook, Lower Lake, $98,217; Contract awarded to Poulos and McEwen, Sacramento, $82,550.

MONTEREY COUNTY—At Willow Springs Maintenance Station, a 12-man bunkhouse and appurtenances to be constructed. District V, Route 56, Section B. George Waters, Santa Maria, $9,422; M. J. Murphy, Inc., Carmel, $9,368; Theo. M. Maino, San Luis Obispo, $8,740; F. C. Stolte Co., Pacific Grove, $8,494; O. R. Ochs, San Luis Obispo, $7,600. Contract awarded to Victor L and William B. Jacobson, Los Angeles, $7,484.00.

SANTA BARBARA COUNTY—Between Gaviota Pass and Santa Ynez River, about 2.9 miles to be graded. Paved with Portland cement concrete and four reinforced concrete bridges to be constructed. District V, Route 2, Section D. Macco Construction Co. Clearwater $299,709; J. E. Haddock, Ltd., Pasadena. $285,923; Claude Fisher Company, Ltd., Los Angeles, $280,633; Griffith Company, Los Angeles, $290,954; Fredericksen and Westbrook, Lower Lake, $297,165; United Concrete Pipe Corp., Los Angeles, $308,684. Contract awarded to C. O. Sparks and Mundo Engineering Co., Los Angeles, $278,535.90.

SANTA CLARA COUNTY—Between Coyote and Llagas Creek, about 10.9 miles to be graded and paved with asphalt concrete and a reinforced concrete bridge to be constructed. District IV, Route 2, Section B, Mg,H,C. Union Paving Co., San Francisco $332,599; Chas. L. Harney, San Francisco, $387,343; A. J. Raisch, San Jose, $362,865; Hanrahan Company, San Francisco, $309,962; Griffith Company, Los Angeles, $354,535. Contract awarded to Jones and King, Hayward, $282,703.05.

SANTA CLARA COUNTY—Between Agnew Underpass and North San Jose Underpass, about 2.6 miles, curb dividing strip to be constructed. District IV, Route 68, Section B. L. C. Seidel, Oakland, $24,298; Granite Construction Co., Ltd., Watsonville, $22,726; Palo Alto Road Materials Co., Palo Alto, $19,434; Chas. L. Harney, San Francisco, $29,478; Piazza & Huntley, San Jose, $21,495; U. Peira & Son, San Francisco, $20,643; F. Kaus, Stockton, $20,185; A. J. Raisch, San Jose, $22,995; Valley Construction Co., San Jose, $20,799; Parish Bros., Los Angeles, $23,265; Earl W. Heple, San Jose, $23,362; B. A. Howkins & Co., San Francisco, $28,591; Lee J. Immel, Berkeley, $21,958. Contract awarded to Harvey E. Conner, Redwood City, $18,992.90.

SAN DIEGO COUNTY—In San Diego, between Barnett Avenue and Miramar Road, 9.7 miles to be graded and paved with Portland cement concrete and asphalt concrete. District XI, Route 2, Section S.D. Oswald Bros., Los Angeles, $358,332; V. R. Dennis Construction Co., San Diego, $354,005; R. E. Hazard and Sons, San Diego, $376,224; Metropolitan Construction Co., Los Angeles, $372,420; Griffith Company, Los Angeles, $354,127; United Concrete Pipe Corp., Los Angeles, $398,208; J. E. Haddock Co., Ltd., Pasadena, $401,523; Daley Corp., San Diego, $348,429. Contract awarded to David H. Ryan, San Diego, $339,886.07.

SAN DIEGO COUNTY—Furnish and apply diesel oil to roadside vegetation at various locations, 68.9 miles. District XI, various locations. R. E. Hazard & Sons, San Diego, $1,458; Consumers Oil Co., Los Angeles, $1,066. Contract awarded to Square Oil Co., Los Angeles, $1,057.50.

Modoc Highway Project Completed

(Continued from page 3)

The work under the contract involved the excavating and handling of approximately 140,000 cubic yards of earth and rock, the placing of 68,000 cubic yards of gravel for base surfacing and the placing of some 18,000 tons of bituminous plant-mixed surfacing. This work involved the expenditure of approximately $202,500.

No effort was spared by the contractor in the performance of the work under the contract. The expeditious manner in which the work was executed and the results obtained were greatly appreciated by all concerned, and particularly so by the motoring public. The major items of work were as a general rule conducted with three working shifts per day and with several operations in progress simultaneously.

The Hanrahan Company of San Francisco was the contractor with A. L. Gladney, as superintendent.



Air spade breaking bank and air tampers backfilling on Cuesta grade.

PROGRESS ON CUESTA GRADE

(Continued from page 7)

four foot centers staked with willows and set in trenches flush with the plane of the fill slope.

No further wash occurred during the heavy rains following this installation.

Surfacing. The road is to be surfaced with plant mix on crusher run base, divided four lane construction with four foot parting strip all on selected material subgrade.

Surfacing operations are expected to start about July first.

Mr. Vic Pearson is Resident Engineer on the project and the Metropolitan Construction Company is the contractor.

This is a Federal Aid Project, the total cost of which will amount to in excess of $800,000.

CUESTA GRADE OVERHEAD

As a part of this project there is being constructed, under separate contract, a reinforced concrete overpass across the tracks of the Southern Pacific Railroad approximately 0.25 miles north of the summit of Cuesta Pass. While the old road crossed over a railroad tunnel it proved impracticable to use the same crossing without sacrificing the high standard of alignment prevailing throughout the balance of the project.

Among the interesting features of the structure, which will consist of 10 spans varying in length from 32 to 59 feet and a total length of 465 feet, are the small angle between the road and the railroad, 22 degrees, which presented quite a design problem; a "rigid frame" type of design with girders and deck continuous over several spans; girders with a parabolic arch of pleasing appearance; two 25 foot roadways separated by a four foot curbed parting strip; and deep footings founded on rock.

The structure is being constructed by Contractor R. R. Bishop, at a cost to the State of $90,000. Federal grade separation funds provide the financing.

Pavement Records

(Continued from page 25)

as compared to 82 miles in 1936. 109 miles of road-mix surface were placed in 1937 by this department, compared to 126 miles in 1936.

The record for surface smoothness of plant-mix, 7.5 inches per mile, was made on Contract 811XC4, road XI-S.D-77-B, Lake Hodges to Escondido; R. E. Hazard & Sons were the contractors and L. E. Liston, the resident engineer. The average roughness for the State in 1937 was 28.6 inches per mile as compared to 33.5 inches in 1936.

The record for smoothness of road-mix, 12.6 inches per mile, was made on Contract 84PWC5-04WC1, road IV-S.M-56-D, Farallone City to Rockaway Beach. Granfield, Farrar, & Carlin were the contractors and H. A. Simard, the resident engineer. The average roughness for the State in 1937 was 31.6 inches per mile as compared to 30 inches in 1936.

STATE OF CALIFORNIA

Department of Public Works

Headquarters: Public Works Building, Twelfth and N Streets, Sacramento

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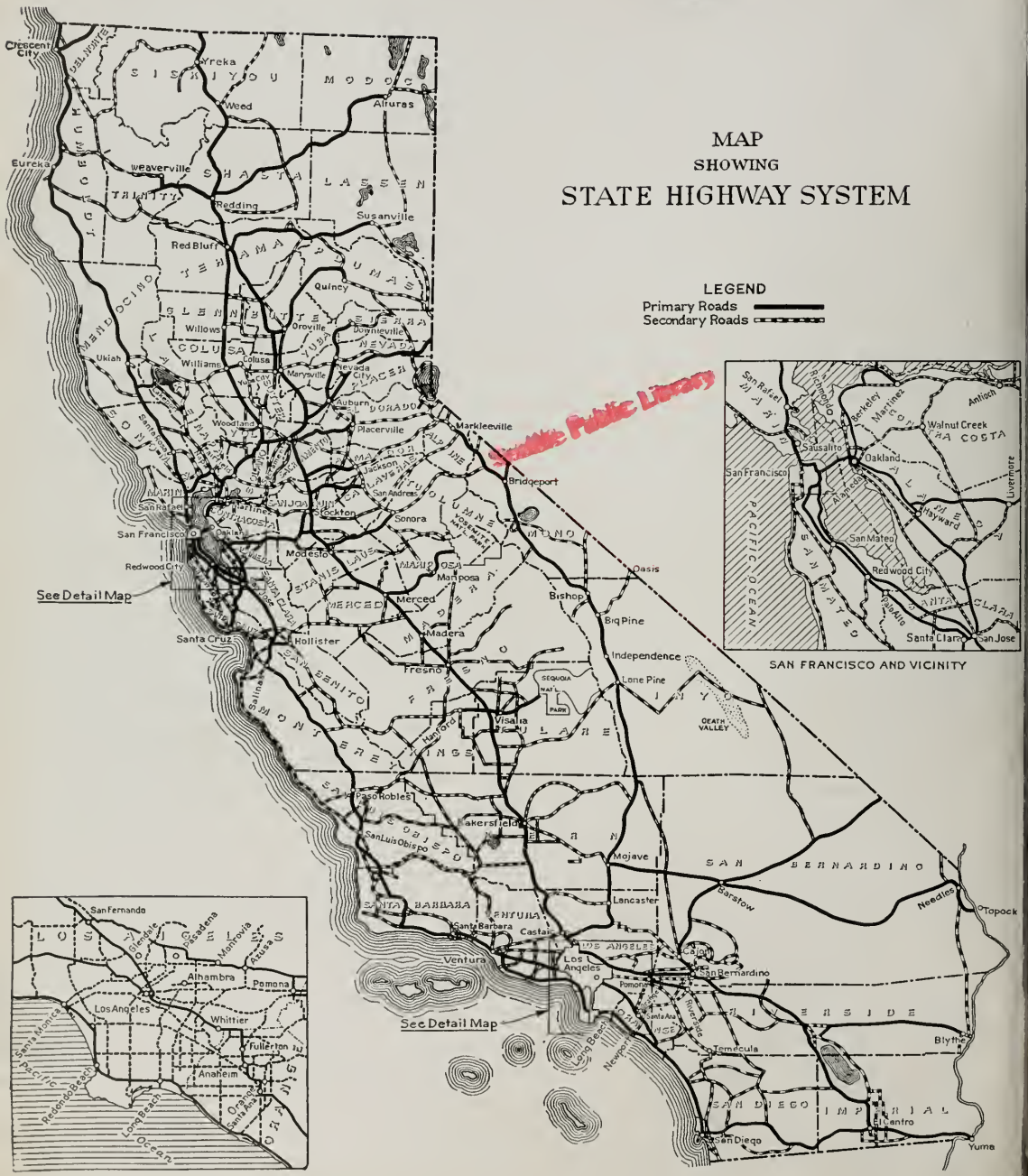
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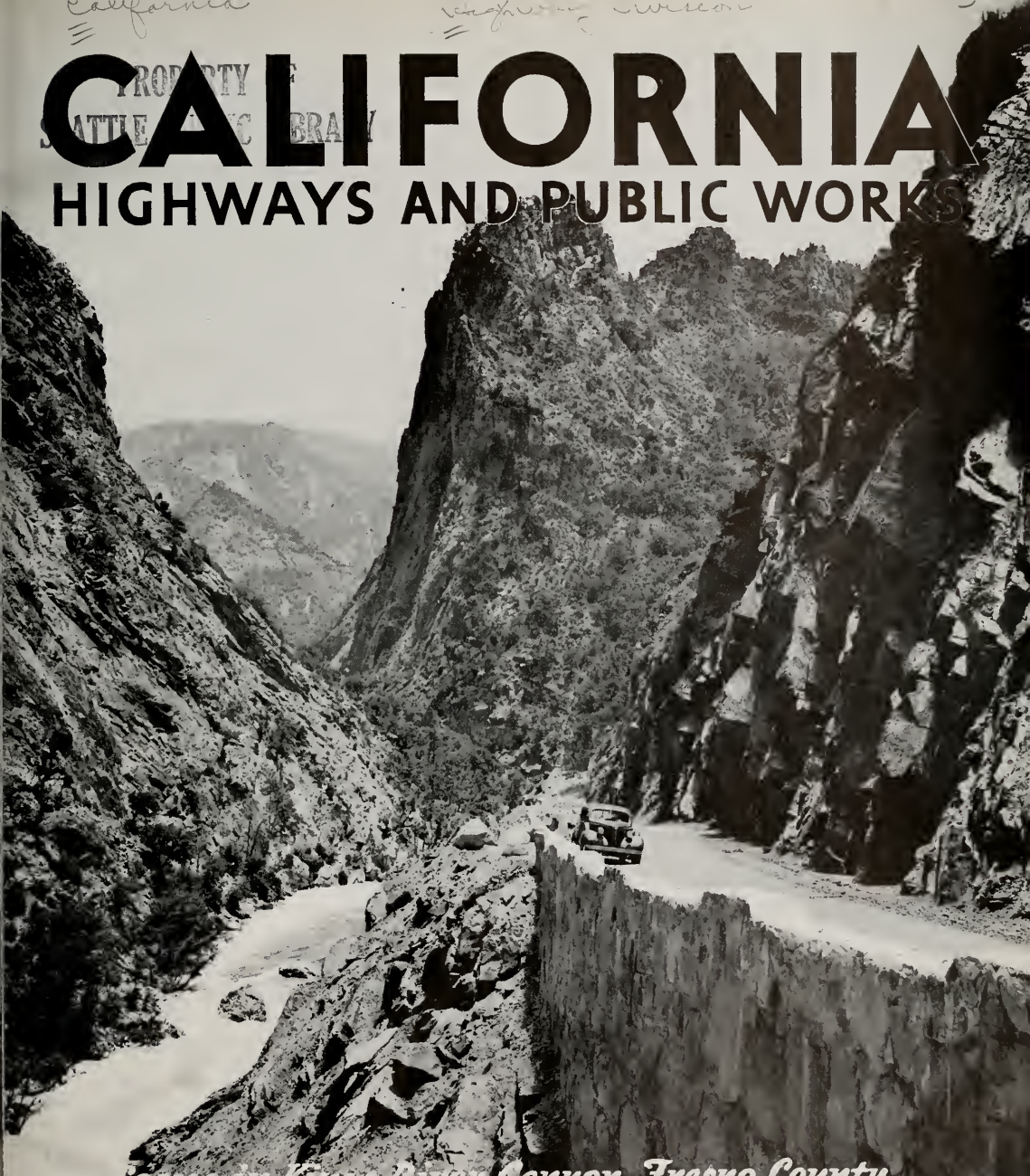
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HIGHWAYS AND PUBLIC WORKS



Scene in Kings River Canyon, Fresno County
Where State Highway [illegible] is under Construction

Official Journal of the Department of Pubilc Works
JUNE 1938

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways of the Department of Public Works, State of California

EARL LEE KELLY, Director C. H. PURCELL, State Highway Engineer JOHN W. HOWE, Editor K. C. ADAMS, Associate Editor

Published for information of the members of the department and the citizens of California

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Vol. 16 JUNE, 1938 No. 6

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Site of Shasta Dam looking downstream. White line shows approximate outline of dam which will be second largest in world, towering 560 feet, storing 4,500,000 acre feet of water and creating a lake 35 miles long.

$35,939,450 Bid for Shasta Dam

By EDWARD HYATT, State Engineer

THE first day of June, 1938, records an event of outstanding significance in the progress of the Central Valley Project—the opening of contract bids for the construction of Shasta Dam. This leads the way to the building of the major and most important unit of the project. It foreshadows the beginning of large scale construction activities on the project in the near future.

Shasta Dam is the "key unit" of the Central Valley Project. It will store and regulate the waters of the Sacramento River to furnish additional water supplies urgently needed for many purposes in the Sacramento and San Joaquin valleys and the upper San Francisco Bay Region. Practically all of the new regulated water supplies to be made available by the project will depend upon the operation of this major storage unit. It, therefore, constitutes the very heart of the project.

LAKE 35 MILES LONG

The site of Shasta Dam is in the Sacramento River Canyon about 14 miles upstream, north of the city of Redding in Shasta County, California.



EDWARD HYATT

The dam when completed will control the run-off from about 6650 square miles of mountain watersheds drained by the upper Sacramento River and its tributaries, chief of which are the McCloud and Pit rivers. It will create a great artificial lake 46 square miles in area and 35 miles in length at maximum level.

Situated in the "Shasta Wonderland" in the midst of rugged timber-covered mountains crowned by majestic Mt. Shasta from which the Dam takes its name, this lake will contribute greatly to the recreational advantages of the area, in addition to its more important objectives of water conservation.

SECOND LARGEST DAM IN THE WORLD

Shasta Dam will be one of the largest in the world—a monumental structure which will rank with the recently completed Boulder Dam on the Colorado River, and the Grand Coulee Dam now under construction on the Columbia River in the State of Washington. It will rise to a height of 500 feet above present low stream level and 560 feet above lowest foundation, or nearly one and one-third times the height of the tallest skyscrapers in San Francisco.



Heavy grading equipment in operation on Los Gatos-Inspiration Point link of new Santa Cruz Highway.

Narrow Santa Cruz Highway Doomed

By H. R. JUDAH, Chairman, California Highway Commission

ANOTHER important high point was reached in the history of California highway building, when Governor Frank F. Merriam played the leading role in ceremonies on May 22d near Lexington, in Santa Clara County, celebrating the heavy grading work now under way in the construction of the important seven-mile unit of the Santa Cruz-Los Gatos highway. This unit extends from Inspiration Point in Santa Cruz County to the Oaks Road, which lies about one and a half miles southerly from the city of Los Gatos.

Ideal weather, coupled with an interesting program brightened by the music of the champion Los Gatos High School band, served to provide an air of pleasure in the realization that the most important stretch of this highly patronized road, used by tens of thousands of Californians and other motorists from all parts of the United States and from across the seas, is really under way.

Former State Senator Bertram B. Snyder was the master of ceremonies and all of the arrangements for the successful affair were managed by representatives of the chambers of commerce of Los Gatos, San Jose and Santa Cruz, ably aided by Mayor Mare Vertin of Los Gatos and J. D. Farwell of the Gem City, one of the most enthusiastic highway boosters in the central section of the State.

In the main address at the ceremonies, Governor Merriam spoke in behalf of the excellence of the California Highway System and its efficient personnel throughout California.

The Governor said the gasoline tax is a fairer means of financing highways than "bonds which outlast the roads they built."

Touching on the element of safety which the California Highway Department is now building into the highway system, he said:

"Safety is a personal matter. The highways are being made as safe as the engineers can design them. Accident prevention is an individual problem with every autoist and should be treated as such."

Ceremonies following the speaking program included the breaking of a bottle of prune juice from Santa Clara County over the side of a giant shovel stationed on the grade by pretty Miss Gloria Daily, clad as "Miss Santa Cruz" in an attractive swimming suit.

An important personality in the dedication was District Engineer Jno. H. Skeggs, closely associated for a quarter of a century with highway work in one of California's most important districts, embracing the counties of Santa Cruz, Santa Clara, San Francisco, Alameda, Marin, Napa, Sonoma and Contra Costa.



In upper picture is section of present winding Los Gatos-Santa Cruz Highway which is to be replaced by broad, straight road shown under construction in center. Lower—Portion of huge drainage system for new road.



Official group at dedication of Los Gatos-Inspiration Point Highway. Left to right: Fred G. Swanton, Santa Cruz; Col. Jno. H. Skeggs, District Highway Engineer; H. R. Judah, chairman, California Highway Commission; Governor Frank F. Merriam, Miss Gloria Daily, "Miss Santa Cruz"; Harry A. Hopkins, Assistant State Director of Public Works; J. W. Vickrey, State Highway Safety Engineer.

It was Colonel Skeggs who watched the progress of the original paving job from Santa Cruz to Los Gatos in 1921 when the old style fifteen foot "trail," costing $39,000 per mile was built, and it was the same man who made a short but interesting talk at the dedication ceremonies on May 22d at Lexington, when he contemplated the work at hand on the magnificent stretch of modern highway, four lanes wide, that will cost $180,000 per mile.

The Los Gatos-Santa Cruz highway was one of the original 1911 bond issue laterals built to connect county seats with the main state arteries. It has served faithfully hundreds of thousands of motorists passing from the north and from the east, southerly into the marvelous recreational area skirting the north shores of Monterey Bay of which Santa Cruz is the center.

Brief talks were made by Mayor Vertin, J. W. Vickrey, State Highway Safety Engineer; and Harry A. Hopkins, Assistant Director of Public Works. Following the dedication, Governor Merriam and a group of officials who participated were entertained at dinner in the Hotel Lyndon in Los Gatos.

The new highway will have a surfaced width of forty-six feet and will require the excavation of about 2,300,000 yards of dirt. The best routing for the new stretch of highway was not easily solved. An entirely new piece of work, it presented a difficult problem, not only in establishing of acceptable grades and alignment in developing within a short distance a descent from summit to canyon floor before reaching Los Gatos, but also in designing the roadway through large cuts and over deep ravines where the character of soil and the presence of underlying water indicated probable instability.

Approximately two miles were saved on the new grade as against the present distance from Inspiration Point to Oaks Road. The curves will be reduced from 132 to twenty and the total curvature now at 7700 degrees will be reduced to 1118 degrees. The minimum radius on curves on the new road is 500 feet, an excellent sight distance on a mountain highway. The present highway has radii as short as 75 feet on curves.

This new million-dollar road unit will be one of the most fascinating from a scenic standpoint in Western America. It will mean, when entirely completed to Los Gatos, that a motorist can leave the beautiful Santa Clara Valley, cross over the Santa Cruz range through unsurpassed mountain scenery on a four-lane road and arrive on the north-

ECONOMY OF HIGHWAYS

"As a rule, citizens think of good roads chiefly in terms of speed, convenience and comfort. The highway research board in Washington has found another advantage—savings in cost of car operations and maintenance. The study was made among rural mail carriers in Iowa. It costs them 3.07 cents a mile to drive their automobiles over dirt roads. Gravel roads, at 2.17 cents per mile, are much better. But a good paved highway is easy enough on gasoline, oil, tires and the like to cut the figure to 1.44 cents per mile. As between the old dirt road and the modern highway is a saving of 1.63 cents per mile—$163 annually for the driver who covers 10,000 miles a year. So good roads become a matter of good business. Motorists willingly paid for them even before the pocketbook argument was evident. But where special taxes levied for road building are diverted to other needs, the driver may well wonder if one factor doesn't offset the other."

—Fergus Falls Tribune.

Road Crews Praised

Big Sur, California.

Governor Frank F. Merriam,
Sacramento, California,

Dear Sir:

Before returning to New York to resume my editorial duties on the staff of the New York Herald-Tribune after a six months' stay here at Big Sur, I want to take this occasion to express to you my appreciation of the splendid work of your highway department. We have lived since November on the new part of the Coast Highway, just three miles south of the Big Sur Lodge, and have seen the terrific rains of this season cause frequent slides and washouts.

What has struck us particularly has been the promptness and persistence with which the road crews have gone out, in all sorts of weather, to clear the roads, and the efficiency with which they have done their work. It has been a tough job for them because of the exceptionally heavy rains, but day after day they have worked hard and long, and, as far as we could see, always cheerfully in the face of many hardships.

Will you be good enough to pass on to the head of your highway department this word of appreciation from an outsider? Such good work is so rare these days that it deserves special commendation.

Sincerely yours,

(Signed) NICHOLAS ROOSEVELT.

AN ACKNOWLEDGMENT

Hon. Nicholas Roosevelt,
Big Sur,
California.

My dear Mr. Roosevelt:

Thank you for your very thoughtful letter of April 20, commenting upon the condition of the highways in and around Big Sur, California.

It is always gratifying to know that the various departments of state government are functioning to the best of their ability, and your courtesy in writing me is greatly appreciated.

Your communication is being referred to the department responsible for this splendid service, the Division of Highways of the State of California, which is under the direction of Hon. Earl Lee Kelly, Director of Public Works.

I am glad that you enjoyed your visit in California and trust you may soon return.

With kindest personal regards, I am

Very sincerely yours,

(Signed) FRANK F. MERRIAM,
Governor of California.

ern shore of Monterey Bay in little over a half hour, probably forty minutes at the most from San Jose to Santa Cruz.

The highway is the main artery from the north into the Santa Cruz mountain and sea recreational area and will carry motorists over easy grades from the great population areas of the San Francisco Bay district and the Santa Clara Valley, where 1,250,000 people reside.

Its completion, scheduled for about July 1, 1939, will follow the completion this autumn of the great Altamont Pass improvement between Greenville and Mountain House. There is a direct relation between these two roads by reason of the fact that seasonal travel from May to November from the great central valleys of the State, passing over the Altamont, normally takes the Los Gatos-Santa Cruz highway to reach Monterey Bay.

Despite all of the inconveniences of the present narrow highway leading southerly from Los Gatos to Santa Cruz covering many years, traffic load records at Los Gatos at peak in recent years revealed 14,000 cars in 16 hours. It is the opinion of the writer that a conservative estimate of traffic on the new highway, when completed, will raise these figures to at least 20,000 cars within thirty days after the job is done, and 25,000 cars within a few years.

N. Y. Federal Projects

In a survey of community improvements in New York City made possible by federal relief projects, Mayor La Guardia of New York says, "A striking illustration is to be found in the field of transportation. In the last four years through federal funds 931 miles of public highways were reconstructed, the Triborough Bridge, the Lincoln Tunnel, and two new bridges over Westchester Avenue in the Bronx and over Wallabout Creek in Brooklyn were built."

Automobiles now use more lubricating oil than all the industrial machinery in the United States. A recent survey by the American Petroleum Institute found that motor cars and trucks used 22,000,000 barrels of lubricating oil last year, while industry consumed slightly more than 20,000,000 barrels.

Highways Come High

Highways in the old days, remarked Governor Merriam in his address last Sunday to an audience of valley and Santa Cruz people, could be built for between twelve and fifteen thousand dollars a mile. That those days are gone forever is due to the fact that roads nowadays have to be built for faster and heavier traffic. The Los Gatos-Inspiration Point road, for instance, when it is completed, will have cost approximately $180,000 a mile to build. This is an unusually costly project, of course, but it is indicative of the amazing increase in cost of road construction. Roads are built wider and sturdier for present day needs.

The Governor brought out another interesting point in his speech, concerning the actual saving that motorists will make when they use the new road. It will reduce the present distance to Santa Cruz by two and a half miles. Thus each motorist, figuring that it costs him five cents a mile to operate his car, will save 12½c, or a quarter on the round trip. During the peak season, as many as 15,000 cars will use the highway daily. So in dollars and cents motorists will save—well you figure it out.

Anyway, Mr. Merriam's point makes good sense, in our opinion. Motorists will pay in taxes for the new highway, but they will have the pleasure of getting some of it back.—*Los Gatos Times.*

SNOW REMOVAL APPRECIATED

A portion of a letter from the Susanville Chamber of Commerce, addressed to J. H. Rust, Maintenance Superintendent, Susanville, says:

"At the regular meeting of the board of directors of the Susanville Chamber of Commerce on April 7th, the board went on record as taking this means of thanking you, for the fine work that you and your maintenance crew did this winter in keeping the highways clear of snow."



Contractor's trucks on new future southbound lane of Bakersfield-Grapevine Highway. Cars on present pavement which will be future northbound lane of four-lane divided highway now under construction.

Highway Safety Being Increased

By R. S. BADGER, District Construction Engineer

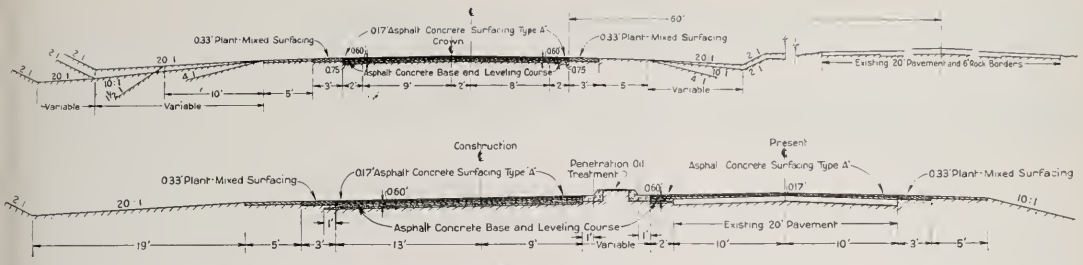
THE highway which connects the metropolitan area around Los Angeles with California's great central valleys is one of the most heavily traveled and important arterials on the State system. Traveling north from Los Angeles County through the deep gorges of Piru Creek on the modern Ridge Route Alternate highway the motorist arrives at the southern end of the San Joaquin Valley, passes down the recently reconstructed Grapevine Grade and out onto the floor of the valley on the long tangent south of Bakersfield.

While the line of this section is tangent, it nevertheless consists of approximately a 5 per cent grade and, because of the high speeds attained in its descent, many accidents have occurred when drivers of both trucks and cars were unable to gauge the speeds at which they and other vehicles were traveling. To remedy, to a considerable extent, this condition by providing more safe highway facilities, the Division of Highways now has under way a construction project 19.1 miles in length between one mile north of Grapevine Station and ten miles south of Bakersfield.

This project consists, in the main, of constructing a new highway parallel to and with its centerline seventy feet to the west of the centerline of the existing pavement. The purpose of the design being to provide divided traffic ways, northbound traffic to use the existing easterly side and southbound cars to use the new pavement on the west. This division of traffic flow will entirely eliminate the chance of the "head on" collision type of accident and should materially reduce the so-called "side swiping" type.

With the exception of the connecting transitions at each end, the new construction will consist of a 23-foot asphalt concrete pavement with 3-foot plant-mix rock borders on each side. The flat roadbed shoulders beyond the borders will be oil treated for a width of five feet.

The 23-foot pavement will be



A 19.1 mile section of divided four-lane highway proposed for construction in Kern County, between one mile north of Grapevine and ten miles south of Bakersfield. Upper—A wide separation strip which will reduce the opposing light hazard and provide protection to cross traffic at intersections. Lower—Curbed dividing strip where right of way width is restricted and approaching transition of three-lane highway.

divided into an 11-foot travel lane on the outside and a 12-foot passing lane on the left. These widths conform to the new standard construction practice adopted by the Division of Highways in 1937 to provide for greater freedom and safety of movement on the highway.

Various other safety features which have proven themselves on other construction are being incorporated in this project at intersections and at the transitions where the divided highway connects with the three-lane pavements at either end.

An important esthetic feature of the project consists in the preservation of the row of shade trees which line the west side of the existing road. As they grow larger these trees will not only beautify the dividing strip but will serve to shade the eyes of motorists traveling north from the rays of the late afternoon sun and will to some extent lessen the headlight-glare at night from traffic traveling in both directions.

IMPORTANT TRAFFIC VOLUME

The divided section will connect at its southerly end with the three-lane pavement placed on the relocation of the Grapevine in 1935 and at its northerly end with the ten-mile

(Continued on page 28)



Looking south on Bakersfield-Grapevine Highway showing present road which is being converted into a four-lane divided highway.

Review of Accidents on Rural State Highways During 1937

By H. L. KILE, Assistant Safety Engineer

IN any attempt at numerical comparison of the motor vehicle accident records as between the current year and any preceding year we immediately become in a sense the victims of our own efforts.

It must be emphasized that only through the proper marshalling of all available facts surrounding the actual occurrence of these accidents can we hope to arrive at a solution of the problem. Every endeavor is therefore made to accumulate more and more data.

We know that in the past many accidents were not reported and that many occur now for which no report is made. However, the growing concern in all walks of life over traffic hazards, and the constant reiteration by those engaged in the search for remedies that we must have all the facts possible, is gradually bringing results.

BETTER COOPERATION

More accidents are being reported, not necessarily because more accidents are happening but because persons involved in these accidents are to a greater extent either submitting reports to the proper authorities or cooperating more fully with the traffic officers, whose complete and carefully prepared reports form an indispensable basis for intelligent study of the hazards of traffic.

Traffic accidents, for purposes of treatment or comment, are in general broadly grouped into three classes according to the gravity of the resulting consequences, as Fatal, Personal Injury, and Property Damage Only.

Provided always that the area under consideration is sufficiently large, and the period of time also sufficiently long, any increase or decrease in the number of fatal accidents for the same amount of travel provides the most accurate guide for comparison for the reason that where a death is involved there is little possibility that it will escape the attention of all of the many public agencies concerned.

The record of fatal accidents may be considered as being complete in any period and is therefore a reliable basis for comparisons if, as stated above, the data are adequately numerous.

The California Vehicle Code requires that in the event of any motor vehicle accident that results in either personal injury or death, the driver—or if the driver be disabled, another occupant of the vehicle—shall make or cause to be made a report of the same upon prescribed forms.

There is not much doubt that a considerable difference exists between the completeness of the record of personal injury accidents and that of fatal accidents. There is not only lack of knowledge of the legal requirements but also wide variation in the interpretation of how serious an injury must be before it is to be considered as reportable, and in addition there are those cases where reports are purposely left unmade and the chance taken that the omission will not be discovered.

Where such conditions prevail we may naturally expect that with increased pressure from many directions the total of such accidents reported will more nearly approach 100 per cent of those that occur and thus to such degree invalidate comparisons with preceding periods.

In the matter of accidents that result in property damage only, there is in California no legal obligation placed upon the driver to render an accident report. Fortunately, however, and primarily through the efforts of traffic officers, many of these accidents are reported and these reports serve to substantially augment the basic data essential to the determination of those traffic conditions and characteristics that most frequently result in accident.

TABLE I—ACCIDENTS ON RURAL STATE HIGHWAYS IN 1937

Type	Number	Per Cent	(1936 Percentages)
Single Motor Vehicle Involved	2,579	29.61	30.97
Two or More Motor Vehicles Involved	6,130	70.39	69.03
Total	8,709	100.00	100.00
Pedestrian also involved (included in above total)	576	6.61	6.64

TABLE II—ACCIDENTS INVOLVING SINGLE MOTOR VEHICLES

Type	Number	Per Cent	(1936 Percentages)
Vehicle vs. Pedestrian	544	21.09	20.47
Vehicle vs. Pole or Tree	313	12.14	11.21
Vehicle vs. Bridge or Culvert	140	5.43	5.64
Vehicle vs. Guard Rail or Posts	75	2.91	3.92
Vehicle vs. Animal	98	3.80	3.37
Vehicle vs. Bicyclist	85	3.30	2.23
Miscellaneous Collision	199	7.72	9.35
Drove Off Road, Skidded, Turned Over	1,086	42.10	40.86
Miscellaneous Non-Collision	39	1.51	2.95
Total	2,579	100.00	100.00

COMPLETE DATA ESSENTIAL

There is little inherent difference between an accident which produces only property damage and one in which a driver, occupant, or pedestrian also suffers injury or perhaps death. In countless instances the finest thread of chance is all that separates one from the other. Naturally, we encourage in every way practicable the reporting of accidents, whether they be fatal, personal injury, or simply property damage, and make the widest use possible of all the data to be derived from each and every report submitted.

TABLE III—ACCIDENTS INVOLVING TWO OR MORE VEHICLES SHOWING COURSE BEING PURSUED AND LANE WIDTH OF ROADWAY.

Type of Accident by Course Being Pursued	NUMBER OF LANES: Two			Three			Four			Miscellaneous			Total		
	No.	%	1936 %	No.	%	1936 %	No.	%	1936 %	No.	%	1936 %	No.	%	1936 %
Overtaking	1,139	26.69	27.15	391	35.13	34.33	262	38.47	39.34	17	24.64	27.88	1,809	29.51	29.39
Approaching	1,926	45.14	46.46	375	33.69	33.06	146	21.44	20.88	8	11.59	34.62	2,455	40.05	41.83
Paths Intersecting—(On same road)	674	15.80	14.18	216	19.41	19.59	132	19.38	19.12	17	24.64	23.08	1,039	16.95	15.67
Paths Intersecting—(Vehicles traveling different roads)	496	11.62	11.15	126	11.32	11.29	135	19.83	17.36	27	39.13	10.58	784	12.79	11.70
Undetermined	32	0.75	1.06	5	0.45	1.73	6	0.88	3.30	---	----	3.84	43	0.70	1.41
Total	4,267	100	100	1,113	100	100	681	100	100	69	100	100	6,130	100	100

The total number of accidents on the rural portion of the State highway system in 1937 for which reports were received, was 8712, indicating an increase of 13.6 per cent over the 7665 reported in 1936. Considered alone, this might present a discouraging picture, since the traffic increase during the same period is estimated to be only 6.7 per cent. However, when we compare fatal accidents only for the two years, we find the increase on rural State highways to have been only 1.2 per cent, in face of a much larger percentage increase in traffic.

Being certain that the record of fatal accidents in both years is practically 100 per cent accurate, the situation then becomes one of encouragement; and instead of disappointment over the increase in total accidents of which we have record, there is the satisfaction of knowing we are acquiring a more complete and comprehensive set of accident facts. Through the increased number of accurate reports, we can better determine how to lessen the number of accidents that are occurring. And that of course is what we want to do.

As the records of accidents accumulate and their various characteristics are segregated into definite groups and combinations, the patterns become more and more fixed and clearcut. Here, too, situations which on casual thought appear discouraging, are in fact cause for encouragement.

Persistent percentages, almost identical in every period analyzed, of various accident types do not mean that nothing can be done about it. Just the reverse, for if the patterns were constantly changing the effort to reduce the hazards would simply lead to bewilderment.

Constantly recurring patterns point directly to those things that require treatment. What that treatment is to be, very likely is not immediately apparent; but with the problem definitely set up, a long step has been taken toward its solution.

Some tables are presented to show a few of the major groups into which the accidents reported as occurring on the rural State highways may be most easily reviewed. The comparable percentages for 1936 are also shown. The manner in which the two so closely parallel each other more firmly establishes the validity of the patterns outlined. These show where efforts must be concentrated.

SINGLE CAR TYPE

A primary division of all accidents between those in which a single motor vehicle is involved and those where more than one car must be considered, is particularly desirable. In those cases where a second vehicle was not present to contribute either directly or indirectly toward the accident, the matter of traffic as the word is ordinarily used need not be taken into account.

On the other hand, where two or more cars are involved, the question of traffic with all of its varied elements becomes of paramount importance. Intelligent study of such accidents can only be made when there is also available definite and detailed traffic data.

Table I presents the accident pattern covering these two general types of accidents and reveals how fixed the percentages appear to be. A third category is shown, representing the percentage of pedestrian accidents. In the very large majority of instances, pedestrian accidents involve only a single motor vehicle.

Table II shows the breakdown of the single-car accidents into the principal types reported. Here again one

(Continued on page 16)

TABLE IV—GENERAL GROUPING OF CAUSES REPORTED AS CONTRIBUTING TO SINGLE-CAR AND TWO-OR-MORE-CAR ACCIDENTS

GROUP	SINGLE CAR: No. of Times Reported	% of Total Causes	1936 Percentages	TWO OR MORE CARS: No. of Times Reported	% of Total Causes	1936 Percentages	TOTAL: No. of Times Reported	% of Total Causes	1936 Percentages
Condition of Vehicle	402	12.03	12.94	458	4.81	6.20	860	6.68	8.14
Condition of Driver	891	26.66	24.87	1,697	17.82	21.94	2,588	20.11	22.78
Speed Excessive for Conditions	828	24.78	22.25	1,286	13.50	12.83	2,114	16.43	15.53
Violation of Right of Way	155	4.64	9.84	5.251	55.13	51.80	5,406	42.02	39.74
Roadway	331	9.90	8.62	524	5.50	6.00	855	6.65	6.76
Pedestrian Involved	542	16.22	16.95	19	0.20	0.32	561	4.36	5.10
Miscellaneous or Undetermined	193	5.77	4.53	290	3.04	0.91	483	3.75	1.95
Total	3,342	100	100	9,525	100	100	12,867	100	100

Note: Total causes reported are in excess of the total number of accidents because of the fact that in many cases more than one cause is reported as contributing to the accident.

HIGHWAY SOIL STUDIES

By THOMAS E. STANTON, Jr., Materials and Research Engineer

The following article comprises the first part of a paper prepared and presented at a recent meeting of the San Diego County Engineers Association. The second part will appear in a later issue of this magazine.

THE study of soils is by no means a new science, but methods of obtaining accurate information regarding the bearing value and other factors affecting the suitability of the various type soils for road and building foundations and highway subgrades and surfaces are of comparatively recent development.

The performance of soils depends upon the character and grading of the constituents. To determine these characteristics a large number of tests has been devised, only a limited number of which, however, are current routine practice at the Laboratory of the Materials and Research Department of the California Division of Highways.

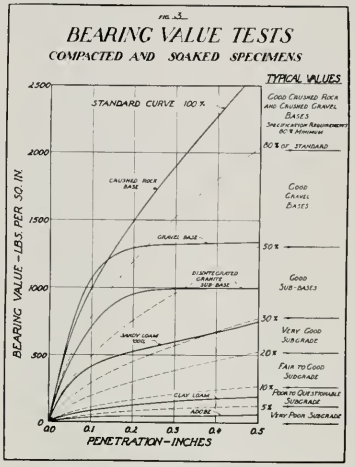
Some of the more common soil tests are the determination of plastic limit, liquid limit, centrifuge moisture equivalent, shrinkage limit, shrinkage ratio, unit weight, void content, moisture content, grain size, mineral composition, consolidation, cohesive strength, angle of internal friction bearing value, and swell.

SIMPLE METHODS FOLLOWED

A complete description of the various identification tests for subgrade soils can be found in a "Report on Subgrade Soil Studies" by the U. S. Bureau of Public Roads, "Public Roads," June to October, 1931.

Consolidation and shear tests are made by California in connection with major foundation investigations for structures and heavy fills. These determinations are necessary to estimate the probable extent and rate of settlement of compressible soils and their resistance to displacement. The methods are also applicable to research studies of subgrade and embankment soils, but the test procedures are not at present sufficiently simplified to be practical for testing thousands of samples yearly.

Due to the large number of soil samples to be tested, our routine methods must be as simple and economical as possible and still furnish



sufficient information to properly evaluate subgrade, embankment, and base materials in relation to their probable roadway performance.

We usually test for field moisture equivalent, lineal shrinkage, cementing value, bearing value, swell and relative compaction.

Chemical tests are also made to detect the presence of injurious salts such as some of the alkalies.

Field moisture equivalent and lineal shrinkage tests assist in identifying soils and estimating probable reduction in volume on drying. These tests are useful as simple field determinations for detecting poor materials. Soils showing a lineal shrinkage value of more than 5 per cent usually consist of heavy clay or adobe, unsuitable for use in the upper portion of embankments or subgrade. Clays having shrinkage values of 3 per cent to 5 per cent may be of a sandy or silty nature requiring a subbase reinforcement of normal thickness under the pavement surface.

Cementing value tests determine the degree to which a material will bind and compact under watering and rolling.

The bearing value and swell tests are for the purpose of determining the two most important subgrade properties affecting pavement service, namely, the resistance to displacement under moist to wet conditions and the volume increase and uplift resulting from absorption of moisture subsequent to construction.

The favorable correlation between test data and field service is one of the principal reasons for the continued use of these tests in lieu of practice which is based largely on analyses of the minus 40-mesh particles. We prefer methods that tend to directly measure the basic physical properties of the combined material as used in the work.

Our bearing value and swell tests as adopted in 1930 are suitable for testing both base and subgrade materials including all of the coarse sand and rock particles up to 1 inch in size. With portable equipment, the tests can also be made locally in the field or in district laboratories, if desired.

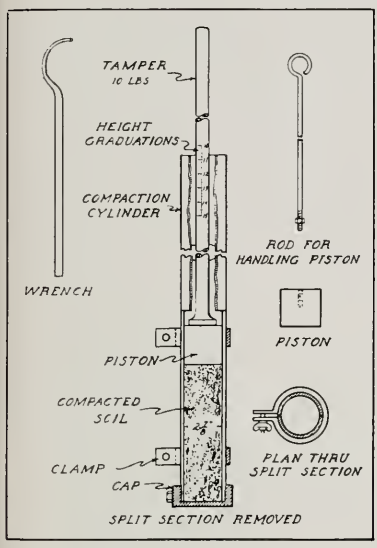
Test results indicate that clays, adobes, and other adverse soils usually have a good supporting value when in a thoroughly compacted and relatively dry state. This ideal condition, however, does not maintain over a period of years. Such material usually absorbs sufficient moisture from rainfall, ground water, or by capillarity, to cause expansion and as a consequence of the increase in water content, the soil often reaches a state of compaction and wetness comparable with the soaked specimens in our standard bearing value test.

MINIMUM BEARING VALUE

A net bearing value requirement of "Not less than eighty (80) per cent" of standard for untreated crushed rock surfacing and crusher run base is included in the Standard Specifications. Special provision requirements for pit run gravel base, imported selected subbase material, and im-

SHOWING COMPACTION OUTFIT FOR DETERMINATION OF OPTIMUM MOISTURE

AS DEVELOPED BY
O. J. PORTER - CALIF. DIVISION OF HIGHWAYS IN 1929



METHOD

SAMPLE MOISTENED AND COMPACTED IN 5 LAYERS WITH 20–18" FREE DROPS PER LAYER

PISTON PLACED ON TOP OF LAST LAYER AND SEATED BY 5–18" FREE DROPS OF TAMPER.

HEIGHT OF COMPACTED SPECIMEN READ FROM TAMPING ROD AT POINT LEVEL WITH TOP OF CYLINDER

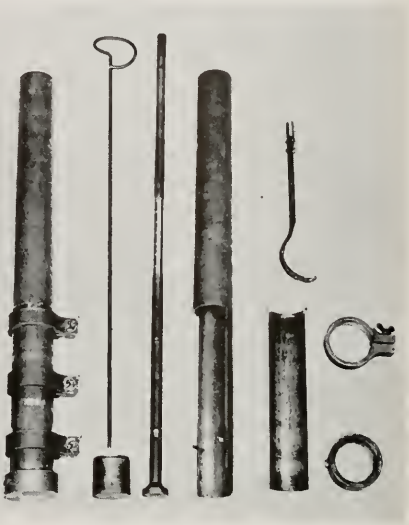
DRY WT PER CU FT. OF COMPACTED SPECIMEN COMPUTED.

OPTIMUM MOISTURE CONTENT IS PERCENT OF WATER BY WT. REQUIRED TO OBTAIN MAXIMUM DENSITY.

THE DRY WT PER CU. FT. COMPACTED AT OPTIMUM MOISTURE CONTENT, IS USED AS A STANDARD IN DETERMINING RELATIVE COMPACTION OF SOIL IN PLACE

RELATIVE COMPACTION: $\frac{W \times 100}{W_1}$

W: DRY WT/CU FT IN PLACE.
W_1 DRY WT/CU FT COMPACTED



ported borrow are varied considerably to fit project conditions and to obtain the best material economically available. For different projects, however, the minimum net bearing value may be set within the following ranges:

Pit run gravel bases and subbases	40% to 60%
Imported selected subbase material	20% to 60%
Imported borrow	10% to 30%

Standard practice calls for the rejection of unsuitable soils, having low bearing value and high swell characteristics, in the top layers of roadway embankments and subgrades. It is frequently impracticable and uneconomical, however, to avoid using poor materials in the construction of the main body of embankments and this fact combined with necessity for securing the greatest practicable consolidation of the embankment as constructed was the occasion of studies started by this department in 1929 from which was developed the theory of optimum moisture content for soils and construction procedure under which our embankments are now being constructed to in excess of 90 per cent of the greatest theoretical density with a given soil.

By optimum moisture in consolidating soils is meant that percentage of moisture which is just sufficient to permit of maximum consolidation under standard construction practice. Any excess of moisture above the optimum results in excess water voids and consequent lower density.

The first work along this line was done by the California Division of Highways in 1929 when an extensive series of tests was conducted from which was developed field equipment and methods of consolidating soil samples to determine optimum moisture requirements before construction

TYPICAL RESULTS OF BEARING VALUE AND SWELL TESTS

Type of material	Minimum bearing value per cent	Swell per cent
Untreated surfacing—all crushed	90 to 150	0 to 1
Good crusher run bases—50% or more crushed	80 to 120	0 to 2
Good gravel bases—uncrushed	40 to 80	0 to 2
Good disintegrated granite	30 to 60	0 to 2
Pit run gravel—poorly graded	10 to 40	0 to 3
Sandy-clay mixture—well graded	15 to 40	0 to 3
Clay—sandy	5 to 15	3 to 6
Heavy clay and adobe	1 to 5	6 to 20

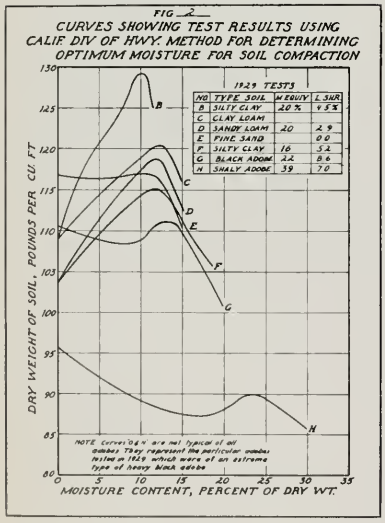
and subsequently the relative compaction of the completed embankment. This procedure and equipment was adopted as standard in August, 1929, and has been in use without substantial change to the present date.

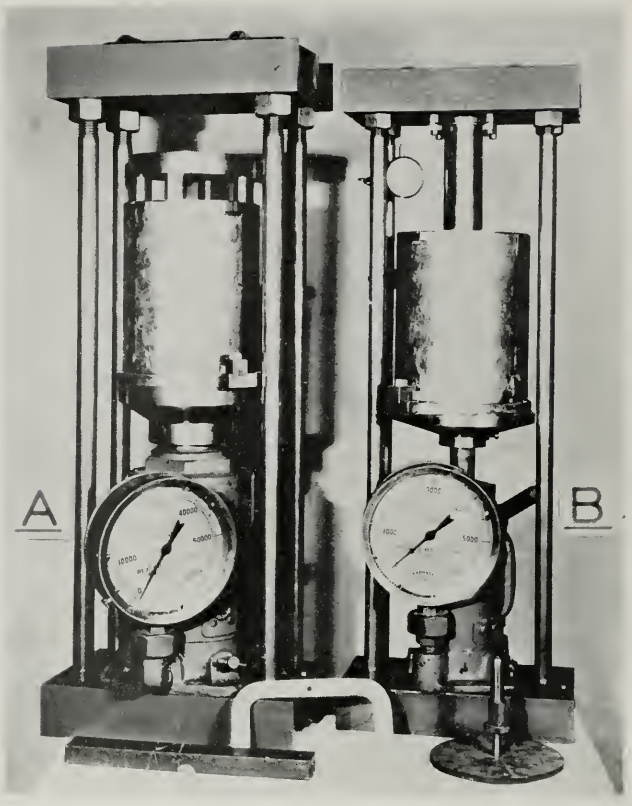
About 1933 the engineers of the bureau of water works and supply of the city of Los Angeles conducted a similar study, the results of which were described in a series of articles by R. R. Proctor, field engineer of the bureau, published in several issues of Engineering News-Record, beginning August 31, 1933.

Proctor describes a field consolidation outfit somewhat different from the California Division of Highways equipment but using similar consolidation procedure.

SOIL NEEDLE DESCRIBED

In addition to the consolidation equipment, Proctor developed a method of testing consolidation in place by means of an instrument known as the "soil-plasticity needle" devised to measure soil plasticity in terms of the pressure required to force a rod with a slightly enlarged bearing surface to penetrate the soil at a rate of about $\frac{1}{2}$ inch per second. For convenience in hand operation rods of various sizes, usually referred to as needles, are used to keep the applied pressures between 5 and 100 lbs. The pressures are expressed in pounds per square inch on the penetrating area and are known as the plasticity-needle penetration resistances or the plasticity needle readings.





Hydraulic jacks compression testing assemblies. A—For consolidating soil sample. B—For bearing test.

The very excellent series of articles by Proctor describe the application of the method to the design and construction of rolled earth dams and further describe construction methods of compacting soils so that they will be sufficiently watertight and will not become soft and unstable if completely saturated with water. He points out that the effect of the moisture content of a soil upon the density to which it may be compacted is the most important principle of soil compaction.

This department has never used the penetration needle for control purposes primarily for the reason that it is not deemed practicable for this purpose in the construction of highway embankments where there is considerable variation in grading of the fill material and considerable coarse aggregate near the surface which will vitally affect the results as determined by the penetration of the needle.

(To be concluded next month.)

CARS ENTERING STATE AVERAGE TWO A MINUTE

Entering the state in a steady stream at an average rate of about two cars each minute of the year, motor tourists established new records for California during 1937, according to official figures reaching the Automobile Club of Southern California touring bureau.

Final tallies revealed that 946,434 passenger cars with 2,588,435 passengers entered the state at the various border stations during 1937.

State Using New Type of Double Line on Crests of Grades

PASSING PERMITTED IF YELLOW LINE IN YOUR LANE

THIS is a roadside sign motorists in California are beginning to frequently observe as a result of experiments by the State Division of Highways to determine the best type of double line to be used on California highways to prevent passing on grades. The Division has adopted the use of a yellow line placed over one line of the double white stripe.

The original marking at points of limited visibility of sight distance on two-lane pavements with the "NO PASSING OVER DOUBLE LINE" signs and corresponding white double lines, restricted traffic to the use of only one lane for the entire length of the double stripe. The observance of this double line was excellent. Motorists recognized that it was placed on these crests and horizontal curves, where the visibility was limited, for their benefit. However, when they had passed the crest, under the terms of the Vehicle Code, if the way was clear there was no reason why they should not pass over the double line and continue on the descending grade, passing the slow moving vehicles ahead of them.

EXPERIMENTS MADE

In passing such slow moving vehicles on the descending grade, it was necessary to cross over the double white line, the signs reading, "NO PASSING OVER DOUBLE LINE." In order to meet this situation and follow the policy used in all signing, that is, "to give the correct information at all times with no signs to bluff the motorist," the Division of Highways began experiments to determine the best method to quickly advise the motorist that passing on down grade or at the end of horizontal curves was permitted.

The methods used elsewhere were studied and tried out. From the results of these experiments, the yellow line was selected and is now being placed over one line of the double stripe, beginning at the crest of a grade and continuing on the descending grade to the end of the double line.

WHEN PASSING IS PERMITTED

Signs are also being placed at the point of beginning of the yellow line, advising the motorist that passing is permitted if the yellow line is in his lane. This method of marking not only gives the motorist the permission to pass if it is safe to do so, but it continues the use of the double line, and if any confusion exists as to whether it is a double white line or a white and yellow line, and the motorist does not pass, he will always be on the safe side.

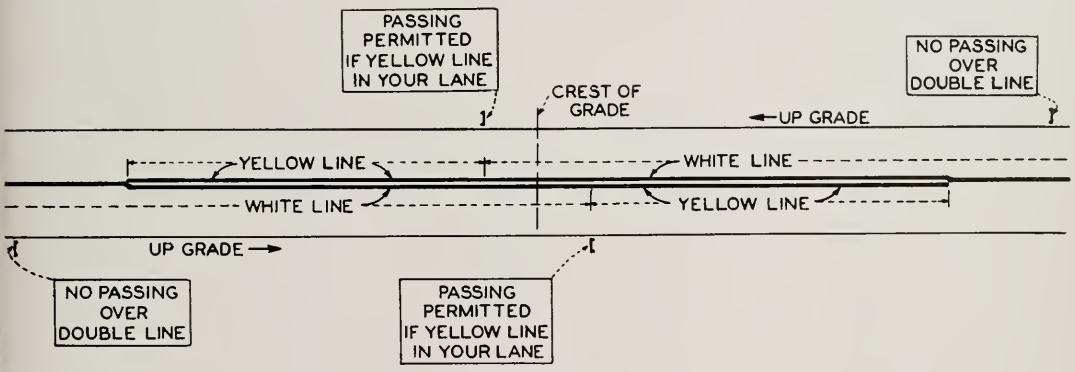
At those locations where the visibility is restricted and the passing might be dangerous, the double white line will continue to be used.

NEW SIGNS

On three lane highways, the double striping at crests of grade to give one lane up two lane down, will continue as it is now used.

Signs reading, "PASSING PERMITTED IF YELLOW LINE IN YOUR LANE" will be positioned at the crest near the beginning of the yellow line.

The Division of Highways appreciates the observance given the warning and regulatory signs by the motorist, and will continue to correct any wrong information or regulation so the motorist will be assured that all signs mean just what they say.

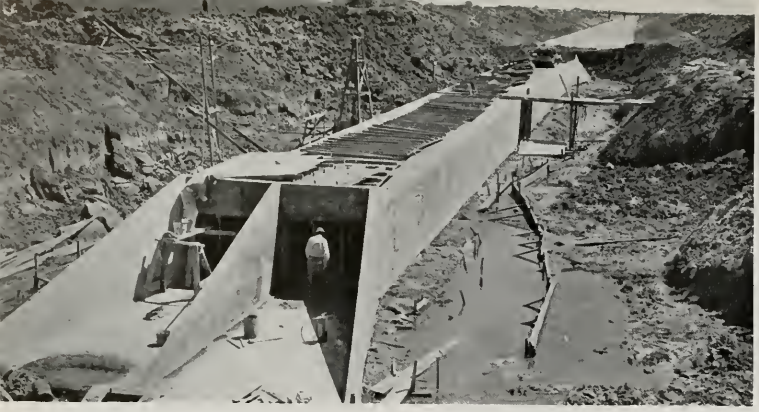


"Halt!" cried the young rookie on his first sentry-go. The major halted.

"Halt!" the rookie cried again.

"I've halted," snapped the major. "What of it?"

"Well," faltered the rookie, "in the manual it says, 'Say halt three times, then shoot'!"



Construction view of Contra Costa Conduit showing syphon under county road and earth canal east of Oakley.

SHASTA DAM BIDS OPENED

(Continued from page 3)

present river level. Preliminary surveys have been made for the relocation of the State highway (U. S. Route 99) and plans are being prepared by the State Division of Highways.

Preparations are well advanced for starting work on Shasta Dam. Construction under contracts let last year is nearing completion on a government camp situated about 2 miles southeasterly of the dam site. This will house the government's forces engaged on the dam and related works. Independent camp facilities will be built by the contractor at a location yet to be selected.

In order to expedite the construction work at the dam prior to the completion of the permanent railroad relocation to replace the present line along the Sacramento River Canyon passing through the dam site, a tunnel will be constructed about 1600 feet long around the right or westerly abutment of the dam to temporarily by-pass the railroad. A contract for this by-pass tunnel was awarded to the Colonial Construction Company of Spokane, Washington, on May 11, 1938. Work thereon is expected to begin shortly and to be completed for railway traffic early in 1939. In the meantime, preparations for starting work on the permanent railroad relocation are progressing.

Commissioner of Reclamation John C. Page has announced that, barring unforeseen difficulties in making an award, work on the dam proper can be started in August. Thus, nearly 20 years after the possibility of a storage reservoir at the Shasta site was originally conceived, work should be actively underway to transform a dream into a reality.

CONSTRUCTION ON CONTRA COSTA CONDUIT

The first actual construction on the Central Valley Project got under way in October, 1937, when work was started on the initial four-mile section of the Contra Costa Conduit. This initial section is now nearly 80 per cent completed. It is an open unlined earth canal extending from the intake at the westerly end of Rock Slough to the first pumping lift near Oakley, with four reinforced concrete siphons to carry the water under highways and drains.

Bids were opened on May 20, 1938, for an additional eight-mile section of this conduit which will consist chiefly of an open concrete-lined canal, but also one tunnel 1360 feet in length and numerous structures. Seventeen bids were received, the lowest of which was submitted by Pearson, Minnis and Moody and Werner and Webb of Los Angeles, at $340,992. These bids are now being studied and it is anticipated that an award will be made shortly.

PROGRESS ON REMAINDER OF PROJECT

Start of construction on the remaining units of the Central Valley Project including Friant Dam, the Madera and Friant-Kern canals and the San Joaquin Pumping System, awaits the completion of negotiations for acquisition of necessary water rights and rights of way. It is possible that 1938 will also see the beginning of construction work on one or more of these other units. The general plans have been prepared and approved for Friant Dam; and final locations have been made covering a considerable length of the canals so that the work could be advertised for bids soon after right of way and water right matters are disposed of satisfactorily.

State Highway Accidents in 1937

(Continued from page 11)

sees how little is the change in percentages of total between the two years.

SIMILARITY APPARENT

In Table III we have given not only the major types of two-or-more-car accidents as represented by the course of the vehicles but have also shown the apparent influence of the various lane widths upon the accident pattern. A glance at this table brings out the remarkable similarity which exists between 1937 and 1936, not alone for the total but for each separate lane-width type.

The first three tables deal with accident types. In Table IV are shown the "general cause groups," being a compilation of all causes reported as having been contributing influences in the occurrence of all the various types of accidents. No claim is to be made that all causes are in every case reported. Many may be so obscure as to escape attention of even skilled investigators. But all evident causes are taken into account and the importance of each individual cause may to a large degree be determined by the frequency of its appearance over a period of time. The general groups listed in this table reveal the same tendency to follow a fixed pattern as that shown in the case of accident types.

While no attempt has been made in this presentation to prescribe the various remedies necessary, it is thought that by demonstrating factually just what the accident patterns are on our rural State highways, all interested groups can more intelligently cooperate in their efforts to lessen the hazards that confront all of us.

Cities Get $7,790,000 Gas Tax for Year Ending June 30, 1938

By L. V. CAMPBELL, Engineer of City and Cooperative Projects

GASOLINE tax allocations for expenditure within the cities of California for the fiscal year ending June 30, 1938, will approximate $7,790,000. For streets of major importance the apportionment represents the net amount of ¼c per gallon tax, which amounts to $3,896,814.22. An equal amount was apportioned for expenditure upon state highway routes within cities.

These gasoline tax allocations to cities result from legislation passed in the 1933 and 1935 session of the state legislature. The State Highway Department's fiscal year ends on June 30, but since the April quarterly apportionment is the last apportionment to be made before that date, the revenue for the fiscal year can be determined upon receipt of the April apportionment.

The fiscal year figures below represent the quarters of July, 1937, October, 1937, January, 1938, and April, 1938. In accordance with a ruling of the Department of Finance, revenue is considered to fall within the fiscal year in which it is paid into the State Highway Fund and becomes available for expenditure by the Division of Highways.

The July apportionment, while considered as coming within the next fiscal year, actually represents collections of the gasoline tax paid into the State Treasury during the months of April, May and June. As the money is not apportioned by the State Controller until July, at which time it becomes available for expenditure, it is considered as revenue of the next fiscal year.

There follows here the final apportionment for each city in California for the fiscal year 1938 and a revised estimate for the fiscal year 1939.

District I

CITY AND COUNTY	STREETS OF MAJOR IMPORTANCE Fiscal Year Ending June 30, 1938	STREETS OF MAJOR IMPORTANCE Fiscal Year Ending June 30, 1939	STATE HIGHWAYS Biennium Ending 1937-39
Del Norte			
Crescent City	$1,559.21	$1,590	$3,150
Humboldt			
Arcata	$1,549.25	$1,580	$3,130
Blue Lake	503.11	510	1,010
Eureka	14,279.53	14,650	28,930
Ferndale	805.90	820	1,730
Fortuna	1,123.18	1,150	2,270
Trinidad	97.01	90	190
Totals	$18,357.98	$18,800	$37,260
Lake			
Lakeport	$1,194.80	$1,220	$2,420
Mendocino			
Fort Bragg	$2,739.51	$2,810	$5,550
Point Arena	349.02	350	700
Ukiah	2,831.97	2,900	5,730
Willits	1,290.89	1,320	2,610
Totals	$7,211.39	$7,380	$14,590
Totals District I	$28,323.38	$28,990	$57,420

District II

Lassen			
Susanville	$1,231.06	$1,260	$2,490
Modoc			
Alturas	$2,119.45	$2,170	$4,290
Shasta			
Redding	$3,796.51	$3,890	$7,690
Siskiyou			
Dorris	$690.77	$700	$1,390
Dunsmuir	2,366.01	2,420	4,790

District II—Continued

CITY AND COUNTY	STREETS OF MAJOR IMPORTANCE Fiscal Year Ending June 30, 1938	STREETS OF MAJOR IMPORTANCE Fiscal Year Ending June 30, 1939	STATE HIGHWAYS Biennium Ending 1937-39
Etna	$343.57	$350	$690
Fort Jones	273.78	280	550
Montague	459.61	470	930
Mt. Shasta	938.93	980	1,920
Tulelake	271.96	270	550
Yreka	1,995.25	2,040	4,040
Totals	$7,339.88	$7,510	$14,860
Tehama			
Corning	$1,248.28	$1,280	$2,520
Red Bluff	3,188.24	3,270	6,450
Tehama	172.24	170	340
Totals	$4,608.76	$4,720	$9,310
Totals District II	$19,095.66	$19,550	$38,640

District III

Butte			
Biggs	$419.72	$430	$850
Chico	7,216.81	7,400	14,620
Gridley	1,759.57	1,800	3,560
Oroville	3,352.33	3,430	6,790
Totals	$12,748.43	$13,060	$25,820
Colusa			
Colusa	$1,918.21	$1,960	$3,880
Williams	787.76	800	1,590
Totals	$2,705.97	$2,760	$5,470

Gasoline Tax Apportionments to Citie

District III — Continued

CITY AND COUNTY	STREETS OF MAJOR IMPORTANCE Fiscal Year Ending June 30, 1938	STREETS OF MAJOR IMPORTANCE Fiscal Year Ending June 30, 1939	STATE HIGHWAYS Biennium Ending 1937-39
El Dorado			
Placerville	$2,145.74	$2,200	$4,340
Glenn			
Orland	$1,083.30	$1,110	$2,190
Willows	1,834.79	1,880	3,710
Totals	$2,918.09	$2,990	$5,900
Nevada			
Grass Valley	$3,460.19	$3,550	$7,010
Nevada City	1,542.00	1,580	3,120
Totals	$5,002.19	$5,130	$10,130
Placer			
Auburn	$2,412.27	$2,470	$4,880
Colfax	826.75	840	1,670
Lincoln	1,898.26	1,940	3,840
Rocklin	656.31	670	1,320
Roseville	5,824.39	5,970	11,800
Totals	$11,617.98	$11,890	$23,510
Sacramento			
North Sacramento	$1,900.98	$1,950	$3,850
Sacramento	84,986.46	87,200	172,190
Totals	$86,887.44	$89,150	$176,040
Sierra			
Loyalton	$758.76	$770	$1,530
Sutter			
Yuba City	$3,268.01	$3,350	$6,620
Yolo			
Davis	$1,126.81	$1,150	$2,280
Winters	812.25	830	1,640
Woodland	5,052.46	5,180	10,240
Totals	$6,991.52	$7,160	$14,160
Yuba			
Marysville	$5,224.28	$5,360	$10,580
Wheatland	434.23	440	870
Totals	$5,658.51	$5,800	$11,450
Totals District III	$140,702.64	$144,260	$284,970

District IV

CITY AND COUNTY	STREETS OF MAJOR IMPORTANCE Fiscal Year Ending June 30, 1938	STREETS OF MAJOR IMPORTANCE Fiscal Year Ending June 30, 1939	STATE HIGHWAYS Biennium Ending 1937-39
Alameda			
Alameda	$31,758.20	$32,580	$64,340
Albany	7,768.00	7,970	15,730
Berkeley	74,433.63	76,370	150,800
Emeryville	2,117.64	2,170	4,290
Hayward	5,013.07	5,140	10,150
Livermore	2,827.43	2,900	5,720
Oakland	257,509.42	264,220	521,730
Piedmont	8,460.57	8,680	17,140
Pleasanton	1,121.37	1,150	2,270
San Leandro	10,384.21	10,650	21,030
Totals	$401,393.54	$411,830	$813,200
Contra Costa			
Antioch	$4,086.60	$4,190	$8,270
Concord	1,019.84	1,040	2,060

District IV — Continued

CITY AND COUNTY	STREETS OF MAJOR IMPORTANCE Fiscal Year Ending June 30, 1938	STREETS OF MAJOR IMPORTANCE Fiscal Year Ending June 30, 1939	STATE HIGHWAYS Biennium Ending 1937-39
El Cerrito	$3,508.24	$3,590	$7,100
Hercules	355.36	360	710
Martinez	6,670.85	7,360	14,030
Pinole	707.99	720	1,430
Pittsburg	8,711.67	8,930	17,650
Richmond	18,301.78	18,770	37,080
Walnut Creek	919.21	940	1,860
Totals	$44,281.54	$45,900	$90,190
Marin			
Belvedere	$453.27	$460	$910
Corte Madera	930.99	950	1,880
Fairfax	2,651.57	2,720	5,370
Larkspur	1,125.00	1,150	2,270
Mill Valley	3,774.76	3,870	7,640
Ross	1,228.34	1,260	2,480
San Anselmo	4,215.33	4,320	8,540
San Rafael	7,272.12	7,460	14,730
Sausalito	3,324.21	3,410	6,730
Totals	$24,975.59	$25,600	$50,550
Napa			
Calistoga	$906.51	$930	$1,830
Napa	5,835.28	5,980	11,820
St. Helena	1,434.13	1,470	2,900
Totals	$8,175.92	$8,380	$16,550
San Francisco			
San Francisco	$575,092.25	$590,090	$1,165,180
San Mateo			
Atherton	$1,200.23	$1,230	$2,430
Bay Shore	1,041.60	1,060	2,110
Belmont	905.61	920	1,830
Burlingame	12,029.54	12,340	24,370
Daly City	7,646.51	7,840	15,490
Hillsborough	1,714.24	1,750	3,470
Lawndale	334.50	340	670
Menlo Park	2,043.32	2,090	4,130
Redwood City	8,124.25	8,330	16,460
San Bruno	3,272.54	3,350	6,630
San Carlos	1,026.18	1,050	2,070
San Mateo	12,198.17	12,510	24,710
South San Francisco	5,614.09	5,760	11,370
Totals	$57,150.78	$58,570	$115,740
Santa Clara			
Alviso	$345.37	$350	$690
Gilroy	3,174.63	3,250	6,430
Los Gatos	2,871.87	2,940	5,810
Morgan Hill	823.12	840	1,660
Mountain View	2,998.78	3,070	6,070
Palo Alto	12,541.73	12,860	25,410
San Jose	56,224.33	57,690	113,910
Santa Clara	5,712.91	5,860	11,570
Sunnyvale	2,804.79	2,870	5,680
Totals	$87,497.53	$89,730	$177,230
Santa Cruz			
Santa Cruz	$13,049.40	$13,380	$26,430
Watsonville	7,833.26	8,030	15,870
Totals	$20,882.66	$21,410	$42,300
Sonoma			
Cloverdale	$688.05	$700	$1,390
Healdsburg	2,081.36	2,130	4,210
Petaluma	7,474.28	7,660	15,140

or Fiscal Year Ending June 30, 1938

District IV—Continued

CITY AND COUNTY	STREETS OF MAJOR IMPORTANCE Fiscal Year Ending June 30, 1938	STATE HIGHWAYS Fiscal Year Ending June 30, 1939	STATE HIGHWAYS Biennium Ending 1937-39
Santa Rosa	$9,641.78	$9,890	$19,530
Sebastopol	1,597.30	1,630	3,230
Sonoma	888.39	910	1,790
Totals	$22,371.16	$22,920	$45,290
Totals District IV	$1,241,820.97	$1,274,430	$2,516,230

District V

Monterey			
Carmel	$2,048.73	$2,100	$4,150
King City	1,344.38	1,370	2,720
Monterey	8,286.52	8,500	16,780
Pacific Grove	5,038.45	5,160	10,200
Salinas	9,485.84	9,730	19,210
Soledad	538.49	550	1,090
Totals	$26,742.41	$27,410	$54,150
San Benito			
Hollister	$3,405.80	$3,490	$6,900
San Juan Bautista	699.84	710	1,410
Totals	$4,105.64	$4,200	$8,310
San Luis Obispo			
Arroyo Grande	$808.60	$820	$1,630
Paso Robles	2,332.48	2,390	4,720
San Luis Obispo	7,502,38	7,690	15,200
Totals	$10,643.46	$10,900	$21,550
Santa Barbara			
Lompoc	$2,579.06	$2,640	$5,220
Santa Barbara	30,470.93	31,260	61,730
Santa Maria	6,397.33	6,560	12,960
Totals	$39,447.32	$40,460	$79,910
Totals District V	$80,938.83	$82,970	$163,920

District VI

Fresno			
Coalinga	$2,584.51	$2,650	$5,230
Clovis	1,192.98	1,220	2,410
Firebaugh	458.70	470	920
Fowler	1,061.55	1,080	2,150
Fresno	47,933.27	49,180	97,110
Kingsburg	1,198.43	1,220	2,420
Parlier	511.28	520	1,030
Reedley	2,346.99	2,400	4,750
Sanger	2,689.64	2,750	5,440
San Joaquin	147.76	150	290
Selma	2,762.16	2,830	5,590
Totals	$62,887.27	$64,470	$127,340
Kern			
Bakersfield	$23,583.17	$24,190	$47,780
Delano	2,385.97	2,440	4,830
Maricopa	970.89	990	1,960
Shafter	266.96	1,170	1,440
Taft	3,120.26	3,200	6,320
Tehachapi	667.19	680	1,350
Totals	$30,994.44	$32,670	$63,680
Kings			
Corcoran	$1,602.74	$1,640	$3,240
Hanford	6,371.04	6,530	12,900

District VI—Continued

CITY AND COUNTY	STREETS OF MAJOR IMPORTANCE Fiscal Year Ending June 30, 1938	STATE HIGHWAYS Fiscal Year Ending June 30, 1939	STATE HIGHWAYS Biennium Ending 1937-39
Lamoore	$1,268.22	$1,300	$2,560
Totals	$9,242.00	$9,470	$18,700
Madera			
Chowchilla	$767.82	$780	$1,550
Madera	4,228.92	4,330	8,660
Totals	$4,996.74	$5,110	$10,210
Tulare			
Dinuba	$2,690.56	$2,760	$5,450
Exeter	2,434.02	2,490	4,930
Lindsay	3,515.49	3,600	7,120
Porterville	4,807.29	4,930	9,740
Tulare	5,626.77	5,770	11,400
Visalia	6,584.08	6,750	13,330
Totals	$25,658.21	$26,300	$51,970
Totals District VI	$133,778.66	$138,020	$271,900

District VII

Los Angeles			
Alhambra	$26,717.03	$27,410	$54,130
Arcadia	4,728.41	4,850	9,580
Avalon	1,719.67	1,760	3,480
Azusa	4,358.56	4,470	8,830
Bell	7,147.02	7,330	14,480
Beverly Hills	15,799.78	16,210	32,000
Burbank	15,104.47	15,490	30,600
Compton	11,346.03	11,640	22,980
Covina	2,514.69	2,580	5,090
Culver City	5,139.08	5,270	10,410
Claremont	2,464.84	2,520	4,990
El Monte	3,153.79	3,230	6,380
El Segundo	3,175.54	3,250	6,430
Gardena	6,385.54	6,550	12,930
Glendale	56,871.57	58,350	115,220
Glendora	2,502.91	2,560	5,070
Hawthorne	5,979.42	6,130	12,110
Hermosa Beach	4,347.68	4,460	8,800
Huntington Park	22,292.29	22,870	45,160
Inglewood	19,418.61	19,920	39,340
La Verne	2,592.65	2,660	5,250
Long Beach	129,231.99	132,620	261,850
Los Angeles	1,124,608.81	1,153,940	2,278,550
Lynwood	6,638.45	6,810	13,450
Manhattan Beach	1,714.24	1,750	3,470
Maywood	6,158.91	6,310	12,470
Monrovia	9,872.03	10,120	20,000
Montebello	4,984.06	5,110	10,090
Monterey Park	5,807.19	5,950	11,760
Pasadena	69,223.85	71,020	140,250
Pomona	18,859.29	19,350	38,210
Redondo Beach	8,473.27	8,690	17,160
San Fernando	6,859.65	7,030	13,890
San Gabriel	6,616.70	6,780	13,400
San Marino	3,381.32	3,460	6,850
Santa Monica	33,673.68	34,550	68,220
Sierra Madre	3,218.16	3,300	6,520
Signal Hill	2,657.93	2,720	5,380
South Gate	17,796.85	18,260	36,050
South Pasadena	12,446.55	12,770	25,210
Torrance	8,008.20	8,210	16,220
Vernon	1,150.38	1,180	2,330
West Covina	868.11	920	1,790
Whittier	13,458.23	13,800	27,260
Totals	$1,719,467.43	$1,764,160	$3,483,640

District VII—Continued

CITY AND COUNTY	STREETS OF MAJOR IMPORTANCE Fiscal Year Ending June 30, 1938	STREETS OF MAJOR IMPORTANCE Fiscal Year Ending June 30, 1939	STATE HIGHWAYS Biennium Ending 1937-39
Orange			
Anaheim	$9,983.53	$10,240	$20,220
Brea	2,207.38	2,260	4,470
Fullerton	9,844.84	10,100	19,940
Huntington Beach	3,345.08	3,430	6,770
Laguna Beach	1,795.82	1,840	3,630
La Habra	2,060.53	2,110	4,170
Newport Beach	1,997.06	2,040	4,040
Orange	7,312.01	7,500	14,810
Placentia	1,455.87	1,490	2,940
San Clemente	604.65	620	1,220
Santa Ana	27,487.56	28,200	55,690
Seal Beach	1,047.94	1,070	2,120
Tustin	839.43	860	1,700
Totals	$69,981.70	$71,760	$141,720
Ventura			
Fillmore	$2,622.56	$2,690	$5,310
Ojai	1,330.77	1,360	2,690
Oxnard	5,697.49	5,840	11,540
Santa Paula	6,755.41	6,930	13,680
Ventura	10,518.39	10,790	21,310
Totals	$26,924.62	$27,610	$54,530
Totals District VII	$1,816,373.75	$1,863,530	$3,679,890

District VIII

Riverside			
Banning	$2,508.35	$2,570	$5,080
Beaumont	1,207.49	1,230	2,440
Corona	6,361.97	6,520	12,880
Elsinore	1,223.80	1,250	2,470
Hemet	2,026.07	2,070	4,100
Perris	691.68	700	1,400
Riverside	26,920.09	27,620	54,540
San Jacinto	1,220.18	1,250	2,470
Totals	$42,159.63	$43,210	$85,380
San Bernardino			
Chino	$2,826.54	$2,900	$5,720
Colton	7,264.87	7,450	14,710
Needles	2,850.11	2,920	5,770
Ontario	12,313.29	12,630	24,940
Redlands	12,851.77	13,180	26,030
Rialto	1,488.50	1,520	3,010
San Bernardino	35,416.01	36,330	71,750
Upland	4,272.43	4,380	8,650
Totals	$79,283.52	$81,310	$160,580
Totals District VIII	$121,443.15	$124,520	$245,960

District IX

Inyo			
Bishop	$1,050.65	$1,070	$2,120

District X

Amador			
Amador City	$155.01	$150	$310
Jackson	1,817.57	1,860	3,680
Plymouth	310.94	310	620
Sutter Creek	918.31	940	1,860
Totals	$3,201.83	$3,260	$6,470
Calaveras			
Angels	$829.47	$850	$1,680
Mariposa			
Hornitos	$56.20	$50	$110
Merced			
Atwater	$831.28	$850	$1,680

District X—Continued

CITY AND COUNTY	STREETS OF MAJOR IMPORTANCE Fiscal Year Ending June 30, 1938	STREETS OF MAJOR IMPORTANCE Fiscal Year Ending June 30, 1939	STATE HIGHWAYS Biennium Ending 1937-39
Dos Palos	$843.07	$860	$1,700
Gustine	921.03	940	1,860
Livingston	727.93	740	1,470
Los Banos	1,699.74	1,740	3,440
Merced	6,405.48	6,570	12,970
Totals	$11,428.53	$11,700	$23,120
Sacramento			
Isleton	$2,634.35	$2,700	$5,330
San Joaquin			
Lodi	$6,596.76	$6,760	$13,360
Manteca	1,463.13	1,500	2,960
Stockton	43,479.53	44,610	88,090
Tracy	3,471.07	3,560	7,030
Totals	$55,010.49	$56,430	$111,440
Solano			
Benicia	$2,640.70	$2,700	$5,350
Dixon	906.52	930	1,830
Fairfield	1,025.27	1,050	2,070
Rio Vista	1,186.64	1,210	2,400
Suisun	820.41	840	1,660
Vacaville	1,410.55	1,440	2,850
Vallejo	13,848.93	14,210	28,050
Totals	$21,839.02	$22,380	$44,210
Stanislaus			
Ceres	$889.31	$910	$1,800
Modesto	12,566.94	12,900	25,470
Newman	1,150.38	1,180	2,330
Oakdale	1,914.58	1,960	3,870
Patterson	820.40	840	1,660
Riverbank	727.93	740	1,470
Turlock	3,876.28	3,970	7,850
Totals	$21,945.82	$22,500	$44,450
Tuolumne			
Sonora	$2,065.06	$2,110	$4,180
Totals District X	$119,010.77	$121,980	$240,990

District XI

Imperial			
Brawley	$9,463.19	$9,710	$19,170
Calexico	5,710.18	5,850	11,560
Calipatria	1,408.74	1,440	2,850
El Centro	7,645.60	7,840	15,490
Holtville	1,593.67	1,630	3,220
Imperial	1,761.37	1,800	3,560
Westmorland	1,338.03	1,370	2,710
Totals	$28,920.78	$29,640	$58,560
Riverside			
Blythe	$924.66	$940	$1,870
Indio	2,357.86	2,410	4,770
Totals	$3,282.52	$3,350	$6,640
San Diego			
Chula Vista	$3,507.34	$3,590	$7,100
Coronado	4,917.88	5,040	9,960
El Cajon	951.84	970	1,920
Escondido	3,101.21	3,180	6,280
La Mesa	2,278.10	2,330	4,610
National City	6,618.52	6,790	13,400
Oceanside	3,185.52	3,260	6,450
San Diego	137,512.05	141,100	278,610
Totals	$162,072.46	$166,260	$328,330
Totals District XI	$194,275.76	$199,250	$393,530



PROPERTIES, INC.

Citizens National Trust and Savings Bank

736 South Hill Street
Los Angeles, California

Mr. S. V. Cortelyou,
Division of Highways, District VII,
808 State Building,
Los Angeles, California.

Dear Mr. Cortelyou:

I presume that most of the letters you receive regarding your work in the field say little about the "effort to please" put forth by your different field organizations. However, I know of one instance where one of your departments certainly exerted more than "the usual effort" to do a good job for the public at large, the State, county, and the owners of Wheeler's Hot Springs, located seven miles from Ojai on the Maricopa Highway, Ventura County.

As you know, the winter floods played havoc with the highway between Ojai and Wheeler's Hot Springs, but your efficient superintendent in charge of maintenance and his loyal and hard working organization, immediately after the flood "went to work," and I know they spared no personal effort and gave no thought to themselves physically in getting the roadway open, which resulted in moving the gate beyond our entrance on Friday morning the 8th instant, for which The Citizens National Trust and Savings Bank, Properties, Inc., and myself and entire organization thank you and your men, and I feel that from the Governor down, including every taxpayer in southern California, we have just cause to be proud of your department.

May the opportunity present itself when we can show our appreciation in some way.

Very truly yours,

JOHN SHERROD HARRIS,
Vice President.

UNIVERSITY OF ALASKA
COLLEGE, ALASKA

Mr. Earl Lee Kelly, Director,
California Highways and Public Works,
P. O. Box 1499,
Sacramento, Calif.

Dear Sir:

Will you kindly place my name on your mailing list in order that I may receive copies of the official journal of the Department of Public Works. I find the articles interesting and desire to use the material in our upper division civil engineering courses along with various other references.

Yours very truly,

(Signed) WM. E. DUCKERING,
Dean of Faculty.

Ensenada, Baja Calif., Mexico.

Earl Lee Kelly, Esq.,
Director of Public Works,
Sacramento, Calif.

Dear Sir:

I have had a chance to see the California Highways and Public Works Magazine in the office of our California representative, Capt. A. F. Somellera.

If it is not asking too much, I would greatly appreciate being put on your mailing list. I sincerely believe your magazine to be one of the most interesting publications and one that can teach a lot to all of us highway builders.

My address is:

Ing. Arturo Carrillo,
Construction Engineer,
Federal Highways Bureau,
Ensenada, Baja California,
Mexico.

Thanking you for your kindness, I am

Faithfully yours,

(Signed) ING. ARTURO CARRILLO,
Construction Engineer.

INTERSTATE TRANSIT LINES
Omaha, Nebraska

Mr. H. R. Judah,
California Highway Department,
Sacramento, California.

Dear Sir:

The many times when members of your maintenance crews have rendered such able assistance to our drivers, make it a real pleasure to write this letter.

The fine work being done by the Highway Commission in building better highways and in keeping them in first class condition is sincerely appreciated by this Company. When you add to this the splendid feeling of good-will shown our drivers by your maintenance men, it makes us want to exert ourselves to the utmost to cooperate with you.

Kindly express to your men our sincere appreciation for their courtesies.

If, at any time in the future we may be able to reciprocate, please do not hesitate to call on us.

Very truly yours,

PATRICK F. PAYNE,
Director of Safety.

Hayfork, Calif., May 2, 1938.

Mr. F. W. Haselwood,
District Engineer,
Division of Highways,
Redding, Calif.

Dear Mr. Haselwood:

I wish to take this opportunity to compliment your organization for the splendid work you accomplished in the maintenance and the keeping of the roads open during the stormy winter just past.

Especially should the workers in the mountain areas be complimented for doing a tireless and conscientious work without regard for number of working hours or fierceness of storm. * * *

Particularly would I like to compliment the efforts of a worker, in the Hayfork district, a Mr. Archipinti. One night when a slide had closed the road Mr. and Mrs. Vern Hodges, our missionaries, were stranded 20 miles from Hayfork. Mr. Archipinti got up and went out there in his own car, carried their provisions across the mucky slide and brought the couple into Hayfork. The next morning he returned to the slide unusually early and had a road bulldozed over the slide, that communication might be maintained without inconvenience. If Mr. Archipinti was not such a conscientious worker, I am sure that a slide of such proportions and nature would have closed the road and inconvenienced everyone for several days.

I believe that such work deserves commendation, and again, I wish to thank you for the unselfish efforts of your organization in behalf of public service.

Sincerely yours,

(Signed) HOWARD L. GRAY,
Field Director,
Philippian Faith Mission.

May 24, 1938.

California Highways
and Public Works,
Sacramento, Calif.

Dear Sir:

I would appreciate being placed upon your mailing list for receiving "California Highways and Public Works" magazine. In my work I try to develop good citizenship in our boys and girls and to do this, endeavor to let them know what their state is doing to improve the well-being of its citizens. I feel that your magazine has a contribution to make.

Very truly yours,

(Signed) NORRIS M. HARTLEY.



This drawing by Artist Carl Nuese from an aerial photograph shows the contemplated roadways that will lead from San Francisco-Oakland Bay Bridge to the Golden Gate International Exposition in 1939.

World's Fair—Bay Bridge Highway

ONLY highway access to the 1939 Golden Gate International Exposition will be via the San Francisco-Oakland Bay Bridge to Yerba Buena Island and thence on a specially constructed six-lane roadway to Treasure Island. Passenger ferryboats will provide other transportation facilities.

Exposition-bound motorists from Metropolitan Oakland will pass through the Bay Bridge tunnel on Yerba Buena Island, turn right and proceed directly to Treasure Island. They will pay a bridge toll at the Toll Plaza at the Administration Building entitling them to a return trip from the World's Fair.

Returning from Treasure Island, East Bay motorists will proceed over a roadway which will cross the Bay Bridge by means of a steel overhead span directly in front of the west portal of the tunnel. The roadway curves around Yerba Buena Island connecting with the bridge on the south side of the east portal of the tunnel.

TREASURE ISLAND TOLL PLAZA

Motorists from San Francisco will reach Treasure Island by proceeding through the tunnel on Yerba Buena Island and turning right over the same roadway used by eastbound motorists mentioned above. Bridge tolls for San Francisco motorists will be paid at a toll plaza constructed just south of the steel overhead span. This toll will entitle motorists to a return trip over the bridge. From the island toll gate, the San Francisco motorists will proceed over the overhead and down an easy grade to Treasure Island.

Returning to San Francisco, fair visitors will proceed directly to the Bay Bridge, turning right from the Treasure Island roadway onto the upper deck of the span.

A lower deck connection is also under construction. This will be a permanent three-lane highway which will tap the bridge on the north side of the lower deck just west of the tunnel, and will connect with the artery from the upper deck.

COST IS $600,000

Traffic lights will be installed at the lower deck connection, which will afford the only left-hand turn in the entire Bay Bridge highway system. The lower deck ramp will be used by trucks only during the fair, but will carry all traffic bound for the air port which will be established on Treasure Island at the close of the exposition.

Only this section of the World's Fair-Bay Bridge highway and three lanes of the six-lane highway between Treasure Island and the bridge connecting with it, will be of permanent construction. All road-



Connection east of Yerba Buena tunnel with World's Fair-Bay Bridge highway. San Francisco motorists having passed through tunnel, will turn right here and circle Island; those leaving Island, bound for East Bay points, will also turn right.

way connections with the upper deck of the bridge will be removed when the exposition is over.

The entire project is being constructed at a cost of $600,000, part of which is defrayed by funds provided in a PWA grant sponsored by the exposition, and part directly by the exposition. Lieutenant-Colonel J. A. Dorst, District Engineer, is directing construction on the project for the United States Army, while exposition participation is in charge of William P. Day, Director of Works for the fair.

The entire temporary roadway system will have six lanes throughout, with a total width of 64 feet. The construction will involve a total distance of 7600 linear feet, including the five separated branches which will serve the different traffic flows.

Included also in the total figure

(Continued on Page 28)

Over this steel overhead motorists will travel returning from the Exposition to East Bay points via the Bay Bridge. San Francisco motorists bound for the Fair will also use the overpass.



TOWNE'S PASS HIGHWAY INTO DEATH VALLEY IMPROVED

By H. F. CATON, Associate Highway Engineer

DURING the past winter a second important improvement has been accomplished on State Highway 127, the western gateway to Death Valley National Monument, by the grading and surfacing of a section of the Towne's Pass road which extends from the Panamint Sink across the Panamint Mountains into the valley near Stovepipe Wells. The improvement covers approximately 3.2 miles of the old toll road on entirely new alignment near the summit of the western slope of the Panamint range. It was begun January 5, 1938, and the road opened to traffic on May 10, 1938. During construction the old road was used as a detour carrying traffic through without delay.

The original road was constructed in 1926 by H. W. Eichbaum, a Death Valley pioneer resident, under a franchise granted him by the Board of Supervisors of Inyo County. A toll of $2 per car and 50 cents per passenger was charged and the franchise was to be in perpetuity unless the county exercised an option to purchase.

MADE FREE HIGHWAY

Shortly after the inclusion of the Death Valley routing in the State highway system in 1933, negotiations were begun by the California Highway Commission for the purchase of the road. The negotiations were brought to a successful conclusion and title vested in the State on December 22, 1934, at a cost of $25,000, making it a free highway.

The toll road was approximately 31 miles in length and extended from the mouth of Darwin Wash, across Panamint Valley and over the Panamint range. The first improvement made by the Division of Highways eliminated the tortuous Darwin Wash sector and was completed in October, 1937.

The original alignment of the toll road was very irregular, of no particular standards and with curves having a radius as low as twenty feet and gradients varying from 10 to 17 per cent. Much of the road was a bladed trail along the gravel bed of various washes and consequently subject to destruction at various points during and after heavy rain storms that occur during summer periods in that area.

THROUGH NARROW CANYON

The first 1.4 miles of this recent improvement traversed the southerly side of a narrow desert canyon consisting of solid and semisolid rock. Drilling and blasting was required through this section. Blasted material was moved with a power shovel and dump trucks and placed in the embankments.

The next 1.5 miles consisted of stony, sandy clay with scattered boulders underlaid with a strata of caliche. This material was moved with scraper equipment.

As this section of road is through a cloudburst area, and the cost of installing culverts to accommodate all drainage would be prohibitive, the fills across the larger washes were made permeable to allow the water to pass through.

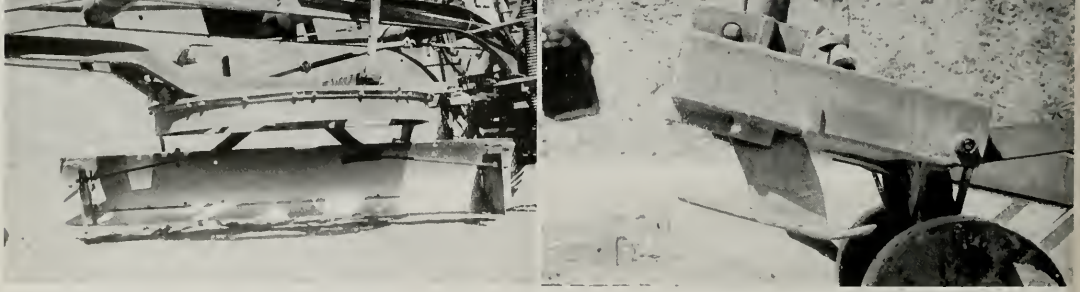
In the larger washes a relief pipe was placed close to the top of the fills. For flood protection of the fills, selected rocky material was placed on the stream side.

The central twenty-foot portion of the roadbed was given a penetration oil treatment consisting of approximately 0.75 gallon per square yard of liquid asphalt, SC-2.

During the progress of the work, certain attachments were made and installed on two pieces of finishing equipment. One attachment consisted of cutting off one rooter tooth and welding a shoe in its place. When the rooter was being used to rip out gutters, this shoe tended to keep the rooter in a level position.

The second attachment was a

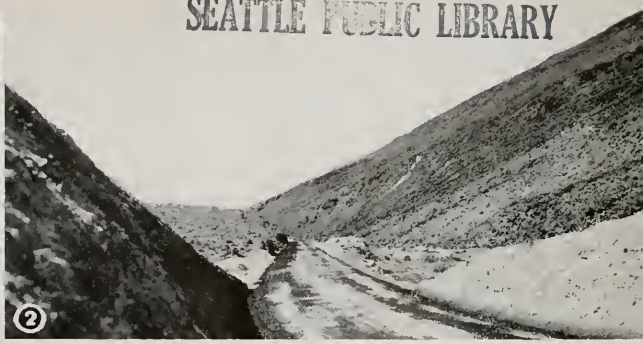
(Continued on page 28)



Two attachments that proved very satisfactory were made and bolted on finishing equipment. At left, plates on grader to make scraper. At right, shoe on rooter tooth used in rooting out gutters.

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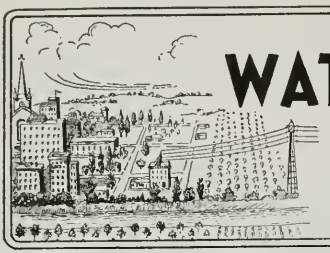








Views of the newly realigned section of Towne's Pass highway entrance to Death Valley National Monument. On the left, views 1, 3 and 5 show conditions before construction that compare with finished highway views 2, 4 and 6 on the right. Drilling and blasting was required through a good portion of the job.



DIVISION OF WATER RESOURCES

OFFICIAL REPORT

FOR THE MONTH OF

May, 1938

EDWARD HYATT, State Engineer



WORK was continued by the Division of Water Resources, representing the Water Project Authority of the State of California, on engineering studies in connection with the Central Valley Project which are being carried on under a cooperative work agreement with the U. S. Bureau of Reclamation. These studies have involved the obtaining of field data to be used in connection with negotiations for the acquisition of water rights of lands along the San Joaquin River which are now being served from that stream. These investigations have included topographic, hydrologic, geologic and soil surveys and studies and the preparation of reports and maps covering these data.

Studies have been continued of matters affecting the disposal of water and power made available by the project including analyses of present ground water conditions and the requirements of certain areas for additional supplies.

Negotiations have been carried on with public utility companies for the relocations of their facilities affected by the construction of certain units of the project.

WATER RIGHTS

Supervision of Appropriation of Water

Nineteen applications to appropriate were received during April: 7 were denied, 18 were approved, 5 permits were revoked and 3 licenses were issued.

Among the permits issued were one to Maxwell Irrigation District for a diversion of 70 c.f.s. at the intake of the Glenn-Colusa Canal for the irrigation of 2000 acres from Sacramento River, and one to Tanner Slough Irrigation Association for the storage of 2600 acre feet per annum on Willow Creek for the irrigation of 8850 acres adjacent thereto.

Because of the continued storms and unusual flood damage, field work started later than usual. However, projects were inspected during the month at the lower elevations from Amador County south to Merced County; in the valley counties from Sacramento south to Merced and in the coastal counties from San Francisco south to San Benito County.

IRRIGATION DISTRICTS

Shafter-Wasco Irrigation District, recently organized on the line of the Friant-Kern Canal, is conducting water spreading experiments this year with the surplus runoff from Kern River. It is hoped by this means to determine, before Central Valley water arrives, where spreading basins can be placed to best advantage to recharge the underground storage.

Oakdale Irrigation District contemplates construction of a storage reservoir at Beardsley Flat on the Middle Fork of Stanislaus River. Water filings have been made and an application has been placed with the Public Works Administration for a grant and loan in the amount of $3,500,000 to carry out the project.

East Contra Costa Irrigation District has completed the installation of six additional drainage wells and auxiliary ditches at an approximate cost of $40,000.

CALIFORNIA COOPERATIVE SNOW SURVEYS

During the first week of May the final scheduled snow surveys for this year were made at all key snow courses. These snow surveys were made for the purpose of determining the amount of snow melting that had taken place in the mountains during the preceding month and to serve as a check on the previously published estimates of stream flow forecast early in April.

The results of these surveys were incorporated in the regular May snow survey bulletin (the final one to be issued this season) released May 11th. A study of these early May snow surveys, with due consideration of April temperature and precipitation conditions, points to the conclusion that no modification of the forecasts issued a month earlier is justified and it is believed that these predicted amounts of runoff will be realized.

FLOOD CONTROL AND RECLAMATION

Maintenance of Sacramento Flood Control Project

During this period streams in the Sacramento Valley have remained generally above bank full stage, and the seepage has continued. Much damage has been done to orchards and alfalfa, and planting of annual crops has been prevented in many places. The extent of the loss from this seepage condition will not be known for several months.

In order to alleviate this condition so far as possible and, after a thorough investigation of all factors related thereto, this office opened the Sacramento weir on the morning of May 14, 1938. At that time the river was rising, but it was immediately reduced about three feet, and since that time the stage at the Sacramento gauge held between 22.0 and 23.0. It seems probable that the stage will not go below 22.0 this month.

Relief Labor Work

During this period from 65 to 80 relief laborers have been employed in cleaning off levees and in miscellaneous work, including clearing for construction on the Sacramento River from Meridian to Butte Slough, construction being done by the California Debris Commission. About 25 men have been available from the SRA Camp No. 7 in the Sutter Basin, up to May 11th, when the camp was closed.

Emergency Levee Repairs

Work has continued in making repairs to levees in Glenn, Shasta, Butte and Tehama counties under Executive Order No. E 177. At this date approximately $85,000 has been expended.

It has been necessary to do further work in protecting the river bank at Robinson Bend on the Feather River. The work has been done with timber and brush and of an inexpensive type. More permanent protection must be installed later.

Emergency Levee Protection

In order to avert a levee break in the Liberty Farms levee in the Lower Yolo Bypass, this office undertook emergency work on May 17th. At this date no danger exists. The cost of the work has been approximately $2,000 to date.

Emergency work is continuing on the San Joaquin River near the Banta Carbona Intake and on Reclamation District No. 17.

Flood Measurements and Gages

The radio senders at the stations so equipped have been removed, as the equipment is now needed on water distribution work. The automatic water stage recorders are in operation and the collection of flood data has been continued.

Highway Bids and Awards for the Month of May, 1938

HUMBOLDT COUNTY—An existing bridge across Yager Creek at Carlotta to be repaired and approaches to be graded. District I, Route 35, Section A. Mercer-Fraser Co., Eureka, $22,070; Albert H. Siemer and John Carcano, San Anselmo, $26,462; M. A. Jenkins, Sacramento, $19,-888; A. Soda and Son, Oakland, $24,770; F. J. Maurer & Son, Inc., Eureka, $20,076; Claude C. Wood, Stockton, $20,293. Contract awarded to E. E. Smith, Eureka, $19,423.

LOS ANGELES COUNTY—Between Philadelphia Street and Painter Avenue, about 1.5 miles to be graded and widened with Portland cement concrete and plant-mixed surfacing. District VII, Route 2, Section D. Vido Kovacevich, South Gate, $36,777; United Concrete Pipe Corporation, Los Angeles, $41,283; Matich Bros., Elsinore, $42,852; W. E. Hall Co., Alhambra, $43,868; C. R. Butterfield-Kennedy Co., San Pedro, $40,721; L. A. Paving Co., Los Angeles, $37,976; Bebek and Brkich, Los Angeles, $40,700; Griffith Co., Los Angeles, $35,991; Oswald Bros., Los Angeles, 37,910; J. E. Haddock, Ltd., Pasadena, $35,196. Contract awarded to George R. Curtis Paving Co., Los Angeles, $34,-413.50.

LOS ANGELES COUNTY—Between Tunnel Station and Placerita Canyon, about 3.7 miles to be graded and paved with Portland cement concrete and plant-mixed surfacing and a reinforced concrete girder bridge to be constructed. District VII, Route 23, Sections L. A., H, I. Daley Corp., San Diego, $467,814; Macco Construction Co., Clearwater, $401,020; United Concrete Pipe Corp., Los Angeles, $438,954; W. E. Hall Co., Alhambra, $482,018; Winston Bros. Co., Los Angeles, $560,843; Claude Fisher Co., Ltd., Los Angeles, $368,027; Sander-Pearson-Minnis & Moody, Los Angeles, $422,334; Gibbons and Reed, Burbank, $431,038; J. E. Haddock, Ltd., Pasadena, $420,878; Oswald Bros., Los Angeles, $395,741; Ralph A. Bell, Monrovia, $428,-596. Contract awarded to Griffith Co., Los Angeles, $348,496.75.

MADERA COUNTY—Between Madera-Friant Road and Kelshaw Corners, about 10.9 miles to be graded and penetration oil treatment applied. District VI, Route 125, Section B, C. Guy F. Atkinson Co., San Francisco, $431,114; United Concrete Pipe Corporation, Los Angeles, $448,228; Winston Bros. Co., Los Angeles, $428,321; Geo. K. Thompson & Co., Los Angeles, $369,297; Granfield, Farrar & Carlin, San Francisco, $358,441; Clyde W. Wood, Los Angeles, $391,432; Griffith Company, Los Angeles, $371,634; George Pollock Co., Sacramento, $392,072; Ralph A. Bell, Monrovia, $414,-037; Isbell Codnstruction Co., Reno, Nevada, $421,534. Contract awarded to Piombo Bros. & Co., San Francisco, $329,779.

MARIN COUNTY—Between Ignacio and San Rafael, about 7.5 miles to be graded, surfaced with Portland cement concrete, asphalt concrete and plant-mixed surfacing, existing structures to be widened and grade separation structures to be constructed. District IV, Route 1, Sections A, S, Rf. Chas. L. Harney, San Francisco, $379,688; Hanrahan Co., San Francisco, $385,002; Fredericksen and Westbrook, Lower Lake, $395,594; Macco Construction Co., Clearwater, $422,690; Union Paving Co., San Francisco, $422,983; Granfield, Farrar and Carlin, San Francisco, $436,791. Contract awarded to A. G. Raisch, San Francisco, $359,783.34.

MENDOCINO COUNTY — Twenty-one miles south of Barberville, a bridge across Bridges Creek, consisting of one 38-foot steel beam span, four 19-foot and one 15-foot timber spans, all on concrete footings and timber bents and two 19-foot timber side hill spans on concrete footings to be constructed and approaches to be graded and surfaced with screened gravel surfacing. District 1, Route 1. Section K. F. J. Maurer and Son, Inc., Eureka, $21,818; Albert H. Siemer & John Carcano, San Anselmo, $25,522; C. W. Caletti & Co., San Rafael, $26,165; Valley Construction Co., San Jose, $27,798; J. W. Walker, Berkeley, $28,740; A. Soda and Son, Oakland, $32,-125; R. G. Clifford, San Francisco, $34,570; Underground Construction Co., Oakland, $38,160. Contract awarded Claude C. Wood, Stockton, $22,790.50.

ORANGE COUNTY—A bridge across Santa Ana River about four miles south of Yorba Linda to be repaired. District VII, Route 175, Section S. E. S. and N. S. Johnson, Pasadena, $15,268; V. R. Dennis Construction Co., San Diego, $15,685; E. G. Perham, Los Angeles, $16,005.18; Dimmitt and Taylor, Los Angeles, $17,081; Byerts and Dunn, Los Angeles, $15,949; R. R. Bishop, Long Beach, $18,869; G. O. Gartz, Los Angeles, $16,899; Contracting Engineers Co., Los Angeles, $16,588; Werner and Webb, Los Angeles, $15,900; J. S. Metzger and Son, Los Angeles, $16,985. Contract awarded to Oberg Bros., Los Angeles, $14,149.

RIVERSIDE COUNTY—Between west city limits of Indio and Route 64, about 2.6 miles to be graded, paved with asphalt concrete and road-mix surface treatment to be applied to shoulders and widened areas. District XI, Route 26, Section Ind., F. V. R. Dennis Construction Co., San Diego, $99,650; Oswald Bros., Los Angeles, $100,-948; W. E. Hall Co., Alhambra, $107,547; United Concrete Pipe Corp., Los Angeles, $111,859; Griffith Co., Los Angeles, $109,-225. Contract awarded to R. E. Hazard & Sons, San Diego, $94,270.

SACRAMENTO COUNTY—Between Ben Ali and U. S. Air Depot, about 3.1 miles to be graded and surfaced with crusher run base and armor coat and a reinforced concrete bridge to be constructed. District III, Route-Feeder road. Piazza and Huntley and Valley Construction Co., San Jose, $66,700; J. R. Reeves, Sacramento, $66,803; Union Paving Co., San Francisco, $66,844; Claude C. Wood, Stockton, $70,691; Parish Bros., Los Angeles, $75,782; J. A. Casson, Hayward, $77,600. Contract awarded to A. Teichert & Son, Inc., Sacramento, $63,452.

SACRAMENO COUNTY—Bridge across Three Mile Slough, 7.4 miles north of Contra Costa Connty line, to be redecked. District X, Route 11, Section C. M. A. Jenkins, Sacramento, $8,140; Bundesen & Lauritzen, Pittsburg, $9,822; F. Kaus, Stockton, $11,-038; W. C. Tait, Inc., San Francisco, $11,317. Contract awarded to C. C. Gildersleeve, Berkeley, $6,514.91.

SAN BERNARDINO COUNTY—Between New Avenue in Redlands and Crystal Springs, about 2.4 miles to be graded and paved with Portland cement concrete. District VIII, Route 26, Section Rld, B. A. S. Vinnell Co., Alhambra, $101,005; George J. Bock Co., Los Angeles, $103,987; V. R. Dennis Construction Co., San Diego, $124,-288; Oswold Bros., Los Angeles, $92,287; George R. Curtis Paving Co., Los Angeles, $89,967; C. O. Sparks and Mundo Engineering Co., Los Angeles, $103,741; Daley Corp., San Diego, $93,987; Matich Bros., Elsinore, $106,583; Basich Bros., Torrance, $95,971; J. E. Haddock, Ltd., Pasadena, $94,171; Griffith Co., Los Angeles, $103,633; United Concrete Pipe Corp., Los Angeles, $100,808. Contract awarded to Claude Fisher Co., Ltd., Los Angeles, $89,929.50.

SAN JOAQUIN COUNTY—Reinforced concrete slab bridge, four 20-foot 9-inch and two 15-foot 6-inch spans on concrete pile bents across Littlejohns Creek, about 0.4 mile east of Farmington, to be constructed. District X, Route 75, Section C. F. Kaus, Stockton, $9,377; Franzini & Fredenburg, San Rafael, $9,565; Claude C. Wood, Stockton, $9,580; J. S. Metzger & Son, Los Angeles, $10,772. Contract awarded to Nelson and Wallace, Escalon, $9,067.50.

SISKIYOU COUNTY—Between Cougar and Macdoel, about 24.1 miles soil cement base to be constructed and imported surfacing material to be placed on portions of the project and entire project surfaced with road-mix surfacing. District II, Route 72, Section B. Hanrahan Company, San Francisco, $109,577; Clifford A. Dunn, Klamath Falls, Oregon, $113,322; Harold Blake, Portland, Oregon, $134,435; J. A. Casson, Hayward, $95,703; Claude C. Wood, Stockton, $100,567; Frederickson & Westbrook, Lower Lake, $106,332. Contract awarded to Oilfield Trucking Co., Bakersfield, $95,479.78.

SOLANO COUNTY—One mile southwest of Cordelia Underpass, about 0.2 mile to be graded and surfaced with plant-mixed surfacing and underdrains to be constrncted. District X, Route 7, Section H. Lee J. Immel, Berkeley, $45,279; Guerin Bros., San Francisco, $47,848; Chas. L. Harney, San Francisco, $73,317. Contract awarded to J. L. Connor and Sons, Monterey, $38,-390.30.

STANISLAUS COUNTY—Between Modesto and Salida, about 5.8 miles to be graded, paved with Portland cement concrete and asphalt concrete and reinforced concrete bridges to be constructed. District X, Route 4, Section Mod., B. A Teichert & Son, Inc., Sacramento, $240,464; Louis Biasotti & Son, Stockton, $195,398; Union Paving Co., San Francisco, $197,313; Macco Construction Co., Clearwater, $199,-839; Griffith Co., Los Angeles, $211,232; Hanrahan Co., San Francisco, $211,951; United Concrete Pipe Corp., Los Angeles, $218,470; Chas L. Harney, San Francisco, $220,497. Contract awarded to Fredericksen & Westbrook, Lower Lake, $194,191.35.

TEHAMA COUNTY—At Red Bluff, about 0.5 mile to be graded and paved with Portland cement concrete and road-mix surfacing on crusher run base to be applied. District II, Route 3, Section D, R, Bl. J. F. Knapp, Oakland, $53,642; Johnston Rock Co., Inc., Stockton, $54,235. Contract awarded to N. M. Ball Sons, Berkeley, $41,625.

TULARE COUNTY—Between Tulare and Visalia, four concrete bridges to be widened. District VI, Route 132, Section A. Franzini & Fredenburg, San Rafael, $16,562; Valley Construction Co., San Jose, $17,518; John Jurkovich, Fresno, $14,812; J. S. Metzger & Son, Los Angeles, $18,500. Contract awarded to Palo Alto Road Materials Co., Palo Alto, $13,694.

Highway Safety Shows Increase

(Continued from page 9)

section just south of Bakersfield which was widened to three lanes a year ago.

The portion of U. S. 99 in this semi-arid region of California carries an important volume of traffic between Southern California and the San Joaquin and Sacramento Valleys and San Francisco Bay area. Much of the large volume of truck traffic is of the heaviest nature, consisting of tanks and trailer units, trucks and trailers.

The following detailed traffic count, taken at the junction of U. S. 99 and State Route 57 leading to Maricopa, is indicative of the volume, nature, and growth of traffic during the past three years:

	Auto	Trucks					
Date	Calif.	For.	Buses	Lt.	Hvy.	Trls.	Total
1-13-35	2920	79	13	95	189	84	3380
7-14-35	4001	105	15	171	221	120	4633
7-12-36	4493	214	21	285	270	162	5445
7-11-37	5149	237	30	238	294	356	6304

The original road was paved in 1916 with Portland cement concrete 15 feet wide and 4 inches thick. In 1922, concrete borders 2.5 feet wide were placed on each side of the pavement and a second story of asphalt concrete 2½ inches thick was laid over the 15-foot pavement. Because of the high crown on which the asphalt was laid, 2¾ inches in 7.5 feet, it tended to drain to the edge and form rough tongues of asphalt on the concrete borders. In 1931 plant-mix surfacing six feet wide was placed on each side beyond the borders and the earth shoulders were oiled for an additional width of six feet.

The present new construction, which will turn this section into the longest single stretch of divided highway on the State highway system, is being performed under a $461,000 contract with Griffith Company of Los Angeles. It is estimated that the final cost of the work will be approximately $500,000 and that the road will be opened to traffic about December 23, 1938.

Doctor: "I'm sorry, but I'll have to open you up again. I can't find my other rubber glove."

Patient: "Don't be silly. Here's a dollar. Go out and buy yourself another pair."

In Memoriam

Ellard Whitney Carson

Ellard Whitney Carson, District Right of Way Agent in District V of the Division of Highways at San Luis Obispo, passed away on May 14, 1938, after an illness of but three days.

Mr. Carson was born September 2, 1877, at San Jose, California. He received his early education in the schools of that city and later prepared himself for the profession of mining engineering. His first employment was in 1897 with the New Almaden Mine, where he rose rapidly to the position of Assistant Superintendent. From 1903 to 1922 he was manager and superintendent of several well known quicksilver properties, notably the Oceanic Mine near Cambria. During this period he also made examinations of many properties in California, Nevada and Arizona. He was a member of the American Institute of Mining and Metallurgical Engineers and retained an interest in this field until his death.

Following the decline in mining after the World War, Mr. Carson entered the real estate business in Los Angeles and San Luis Obispo, gaining the invaluable experience that later was to make him one of the State's outstanding right of way men.

The Division of Highways employed Mr. Carson as District Right of Way Agent on May 13, 1927. During his eleven years of unbroken service in that position, he directed with conspicuous success the many difficult and complex negotiations peculiar to a section embracing old Spanish land grants, rich oil lands and valuable citrus and vegetable farming acreage.

World's Fair Highway Under Construction

(Continued from page 23)

are 536 feet of permanent steel trestle (providing the lower deck connection); 4600 feet of temporary timber trestle; and 460 feet of temporary steel bridge and trestle, some of which comprises the overhead span crossing the upper deck of the Bay Bridge. There is an estimated excavation of 155,000 cubic yards.

Except for special requirements, the general project will be a standard Class A highway construction with regard to banking (on curvatures), runoffs, and breaks of grade. The maximum grade will be 6 per cent and the minimum curvature a 275-foot radius which is obtained on one curve only.

A 7-inch crushed rock base on ground contacts, and an approximate 2-inch base for the timber deck will be provided for a three-quarter inch black asphaltic surfacing. The timber deck itself will comprise 3 x 4 and 3 x 8 timbers laid on edge.

The permanent construction is designed for H-15 loading, and the temporary sections for H-10. Wheel loads and impacts conform with State highway specifications. Steelwork is designed according to Bay Bridge requirements, and timber construction conforms with recommendations of the Structural Engineers' Associations of California.

Parking facilities for 12,000 cars are provided on Treasure Island. The World's Fair-Bay Bridge Highway is expected to be completed this summer.

Towne's Pass Road Improved

(Continued from page 24)

plate 18 inches long bolted on each end of the moldboard of the blade grader and at right angles to the blade. This was used as a scraper and worked very satisfactorily during finishing operations. In the through cuts, rocks were bladed to the center of the road, and with this attachment on the blade, were scraped out of the cuts and then bladed over the fill slopes.

Since the completion by the State of the Darwin Cut-Off sector, eliminating the grade over Zinc Hill, the travel using the Towne's Pass entrance into Death Valley has more than doubled the past year

For the period January 1, 1937, to April 30, 1937, 2255 cars and 6413 people entered the valley. For the same period in 1938, 4688 cars and 13,655 people entered, or an increase of 107.8 per cent in the number of cars and 112.7 per cent in the number of people.

The heaviest traffic recorded entered the valley Saturday, April 9, 1938. On that day 262 cars and 845 people were recorded. At all other checking stations into the valley there was no increase in traffic over previous years.

The cost to the State of this latest improvement was $33,589.81. The Silva and Hill Construction Company was the contractor.

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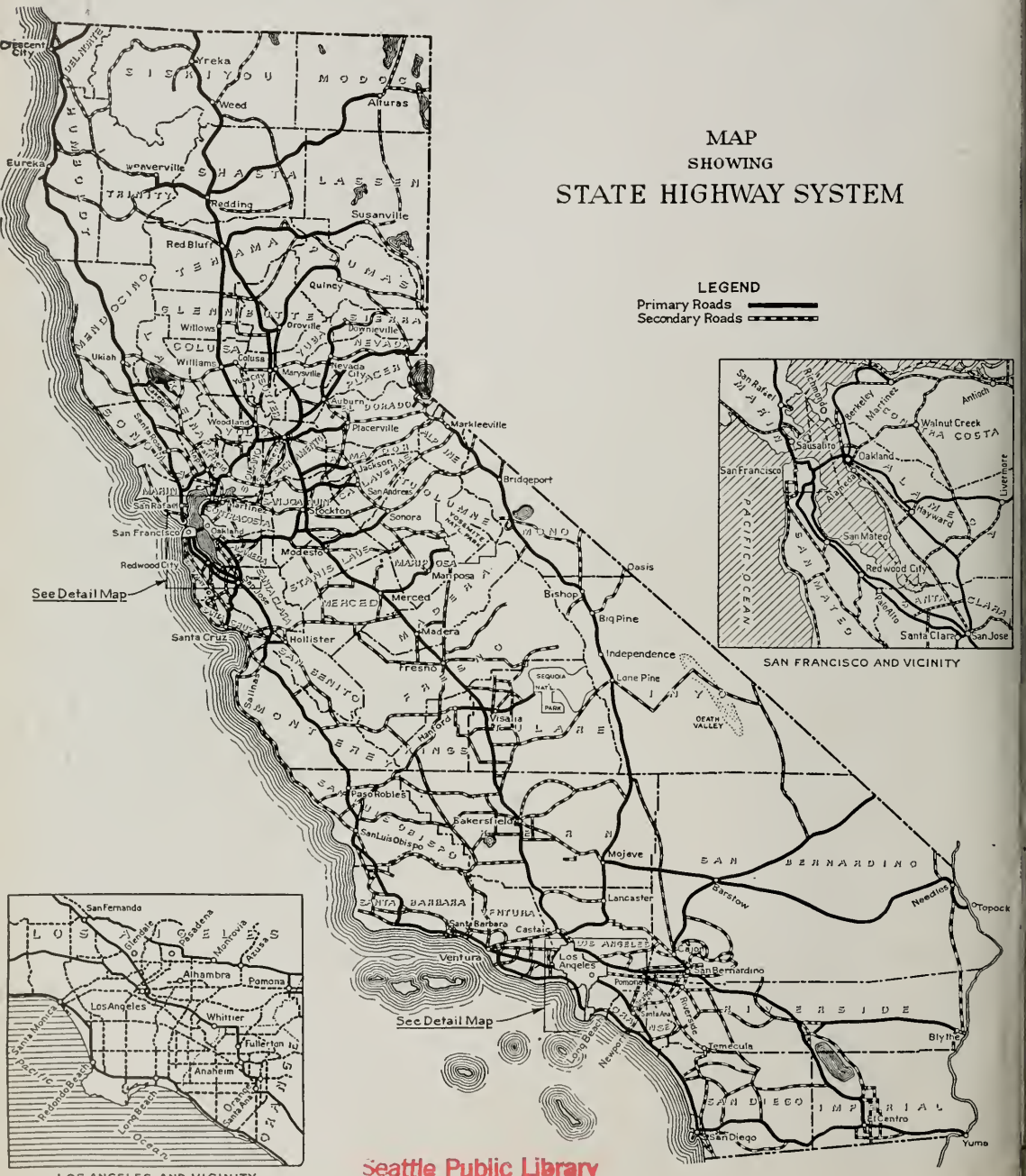
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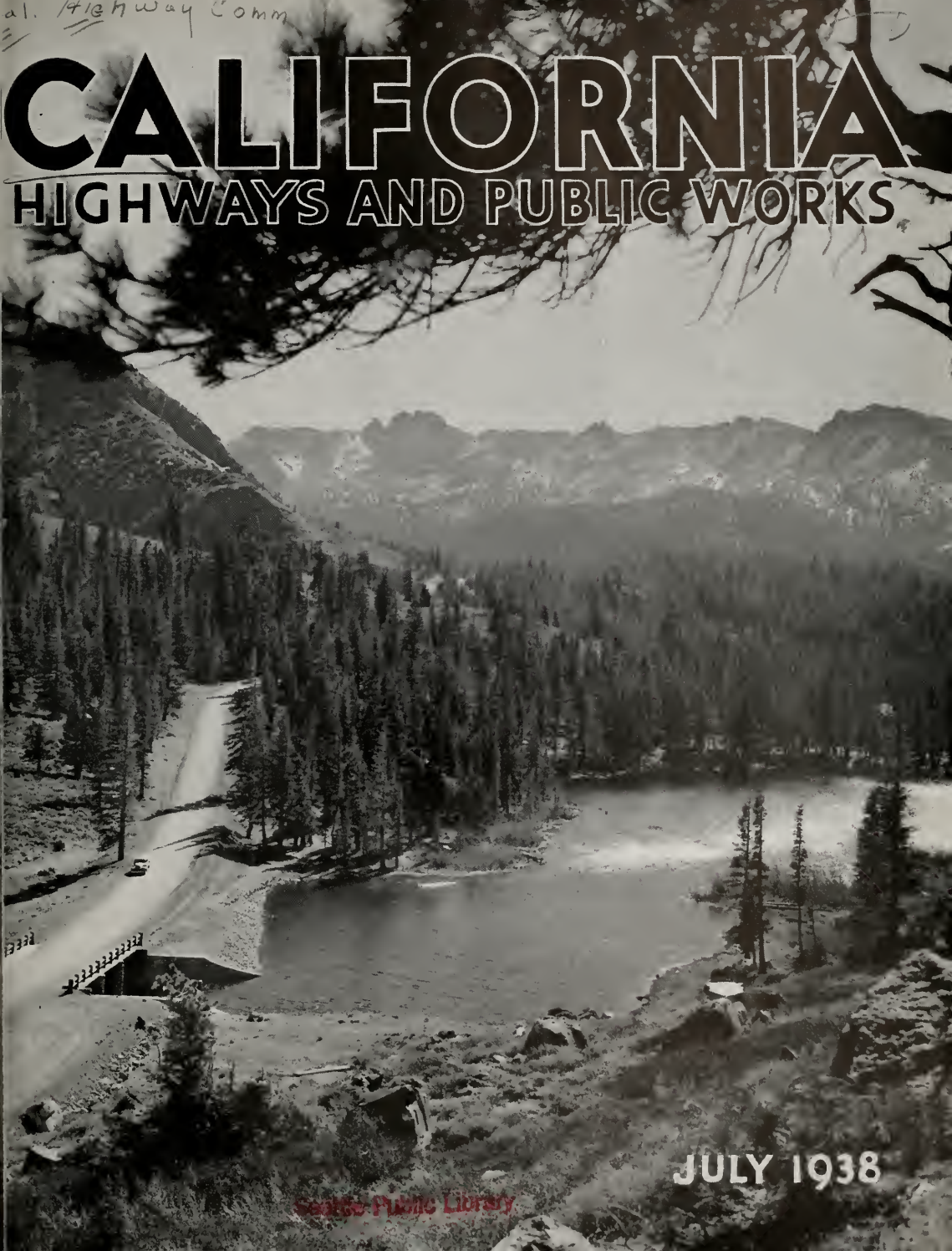


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CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways of the Department of Public Works, State of California

EARL LEE KELLY, Director C. H. PURCELL, State Highway Engineer JOHN W. HOWE, Editor K. C. ADAMS, Associate Editor

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Vol. 16 JULY, 1938 No. 7

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Lack of Paved Roads Serious

By F. W. HASELWOOD
District Engineer, Dist. II

THERE have been many critical periods in the brief history of California highway progress. The story of the rapid increase in number and weight of motor vehicles and their radius of travel is a familiar one. The efforts that have been made to meet the requirements of this growing traffic in highway financing, design and construction may not be so well known. Necessarily, as motor vehicle traffic increased there was need for an expansion in the highway system to serve a wider area and a change in standards to meet the new requirements. The initial mileage of 3000 has now become 14,000, and standards of highway design have been greatly modified.

The latest expansion in highway mileage occurred in 1933 with the addition of some 6600 miles, with a public anticipation that all of these additional roads would immediately be improved. There were no increased finances to take care of these roads. In fact, the construction fund was immediately reduced by about $1,500,000 required for maintenance, then one-half cent of the gas tax was assigned to the cities.

Regardless of how essential these uses were, the effect was to reduce by more than half, the funds available for highway construction at a time when the highway mileage was doubled. The effect of this decrease in finances in relation to increased needs was somewhat obscured as far as the public was concerned by the Federal emergency funds that were allocated to the states during the depression. Since these supplemental funds are no longer available, the situation is becoming so acute as to constitute a new crisis in highway affairs.

From the beginning, the problem on California highways, as well as on those of every state in the Union, has been to provide quick service over the entire mileage. The inevitable result was that as traffic expanded in volume, increased in speed, and changed in weight of loads, these earlier roads became obsolete as to alignment, grade, and width, and inadequate as to durability of surface.

Adequacy of design and improvement was not in sight when the system was doubled in 1933. The only procedure possible in connection with the added mileage, which was of very low standard, and, in some districts, was entirely unimproved, was the lowest type of improvement that would as quickly as possible make these roads dustless and mudless.

In order to get a closer picture of the highway problem as it exists today in California, the District Engineers in each of the eleven highway districts in the State have been asked to report on the conditions and needs in their respective jurisdictions.

The situation in District II is presented in the following report by District Engineer F. W. Haselwood:

District II one of the eleven California highway districts, occupies the northeast corner of the State, including all or portions of nine counties with 1400 miles of highway. The area is largely mountainous. The climate in winter is severe and road surfaces must support heavy snow removal equipment.

Of the high type pavement, 87 miles are obsolete as to alignment and width, or inadequate as to thickness and serviceability, or both. Of the intermediate type surface, 217 miles are of stage construction and will require addi-



Types of unimproved road in Shasta (top), Plumas (center) and Siskiyou counties in District II.







Top—Sharp curve, narrow roadway and narrow bridge combine to make unsafe this Plumas County road. Center—This sharp alignment, steep bridge approach and blind vertical and narrow bridge are at city limits of Redding. Bottom—This narrow bridge in Tehama County requires careful driving.

tional increments of surface at intervals.

The status of improvement on these 1400 miles, which is just 10 per cent of the state's total mileage is:

67 miles, or	5%	unimproved and unoiled earth roads.
483 miles, or	34%	oiled earth roads, inferior as to grade, alignment and width.
386 miles, or	28%	graveled roads with light oiled surface.
327 miles, or	23%	intermediate type of surface.
137 miles, or	10%	of high type pavement.

All of the graveled and earth roads require periodical construction and heavy annual maintenance expenditures to keep them in service until more substantial work can be financed. In other words, most of the work done to date has had to be inadequate to cover as much mileage as possible, and the problem of holding it together at all requires so much of the biennial allocation that little progress can be made toward more substantial improvement.

An examination of the status of improvement of the 1400 miles of highway in District II reveals that to bring these roads to the standards required by present day traffic, 649 miles, or 46 per cent, will require grading at a cost of $14,000,000. Of this, 272 miles will be entirely new construction and 377 miles will be widening or realigning present obsolete roads.

When it comes to surface, we find, by reason of the necessity of following the expedient of stage construction, by which light surfaces are constructed and strengthened periodically by additional increments, that some work will have to be done on 1349 miles at a cost of $16,000,000.

There are about 35,000 lineal feet of bridges that need widening or replacement by reason of being structurally weak, too narrow, or located on obsolete alignment. The cost of these bridges will be about $5,250,000.

The total cost of grade surface and bridges to satisfy present demands aggregates $35,250,000.

Of course this improvement is not going to be accomplished immediately,

Top—Obsolete alignment and inadequate 15-foot pavement in Siskiyou County. Blind vertical curve in left background. Center—Narrow oiled earth road in Tehama. Poor alignment and narrow inadequate bridge. Bottom—This 14-foot roadway in Trinity has many hairpin turns on grade.

and traffic must be served in the meantime even though at an exorbitant maintenance cost. A reasonable program that would result in the improvement of these roads in a period of 16 years, provided that during this period there are no additions to the system, and that the requirements of traffic and standards of highway design are not materially changed, would call for an annual construction expenditure of $2,300,000. This is twice the amount now available to the district.

This would provide for seven miles per year of high type pavement, 30 miles of intermediate type, 30 miles of completion of stage constructed surfaces, a variable mileage of periodical surface treatment, together with the necessary grading and about $330,000 for bridge construction.

At the end of this 16-year period 152 miles, or about 11 per cent of the roads in the district would be surfaced with high type pavement on standard alignment and the remainder with intermediate type.

On at least 900 miles the graded width would not exceed 26 feet, and there would not be more than six miles of multi-lane road outside of incorporated cities.

Even this status could not be considered as entirely adequate for it is becoming increasingly apparent that intermediate type surfaces are not sufficiently durable where heavy snow equipment must be operated. These roads must some time be provided with more durable pavement.

(The needs of another highway district will be described by a District Engineer in next month's issue of California Highways and Public Works).

An English reporter, frequently reprimanded for relating too many details and warned to be brief, sent in the following:

"Last night Sir Dwight Hopeless, a guest at Lady Panmore's ball, complained of feeling ill, took a drink, his hat, his coat, his departure, no notice of his friends, a taxi, a pistol from his pocket, and finally his life. Nice chap. Regrets."









Kings River Bridge. Abutments and center pier complete. Superstructure half complete. Kings River, nearing flood stage, is roaring through canyon.

New Scenic In Kings

By R. S. BADGER, D

THERE is an increasing and eager interest shown by the public in the progress of construction on the Kings River Canyon Highway. This project forms a portion of State Highway Route 41. It lies between the northerly boundary of General Grant National Park and Deer Cove Creek, where it joins the South Fork of Kings River. The U. S. Forestry Service will extend this road with a Forest Highway from Deer Cove Creek into Cedar Grove and on up the South Fork to Copper Creek and another beautiful recreational area will be opened to the public.

The construction work from General Grant Park to the crossing of Ten Mile Creek involved very heavy excavation quantities. However, from this point to the Kings River crossing at Windy Cliff, not only was there encountered much heavier yardage, but the character of the country rendered construction much more difficult.

Hard, fine-grained granite and metamorphosed sedimentary deposits, the latter upturned to form vertical cliffs, made the task of cutting the highway along the mountain side very difficult.

In certain spots the steep cliffs lay in such irregular alignment that thorough cuts involving large quantities of rock excavation were necessary in order to provide room for the roadway. At many other places foundations for high masonry walls were carved out of the steep rocky face of the mountain and in one location, where no footing could be obtained for a wall, an arch was built to carry the outer half of the road over a steep niche in the cliff. The remainder of the roadbed width at this place was benched into the face of the cliff.

One of the spectacular features of the construction was involved in the blasting of a coyote tunnel at Horse

Highway River Gorge

t Construction Engineer

Shoe Bend. In this section the river gorge winds through an "S" bend, cut to startling depths through vertical rocky cliffs.

In order to give reasonable alignment to the road in this section, very heavy rocky cuts were required. A coyote tunnel from four to six feet in diameter was driven along the proposed inside gutter line of the roadway for a distance of 570 feet. At intervals stub tunnels were cut leading across the proposed roadbed. In each of these tunnels and in the main tunnel along the gutter line, charges of powder were placed and the entire remaining space in the entire tunnel system was backfilled with the material previously excavated. One battery shot was then made to explode 37 tons of powder. The view from the roadway at this location now forms one of the striking features of the varied scenery along this route.

From the crossing of the river at Windy Cliff, the character of the location changes decidedly. The roadbed follows about 15 feet above the river and involves comparatively light excavation yardage.

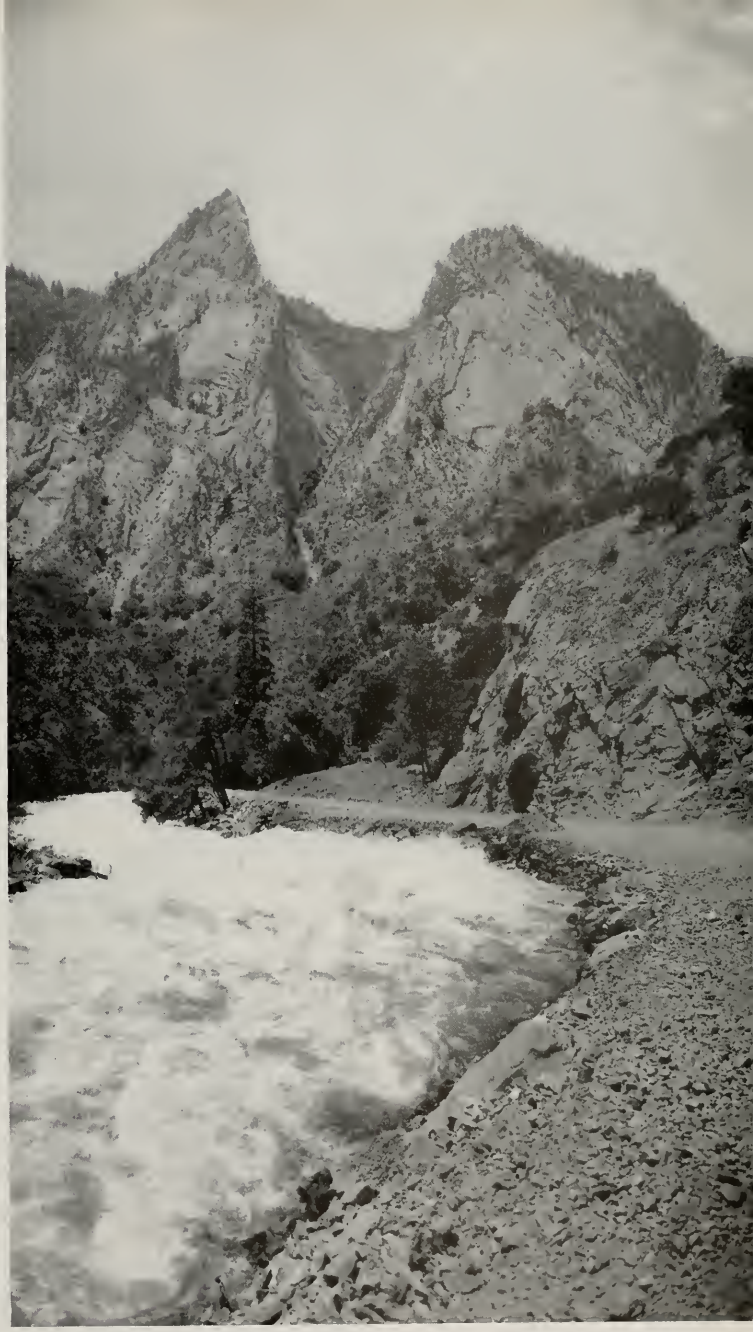
Throughout the whole project the tourist will be treated to a charming variety of scenery. The grandeur of the Kings River country is nearly equal to that of Yosemite.

Sequoia and General Grant Parks have always drawn tourists into this section of the Sierras. When finished, the Kings River project will add greatly to the attractiveness of their trip.

Sequoia National Park covers an area of 604 square miles. It contains twelve redwood groves, among which is the Giant Forest of 3200 acres with 500,000 stately trees. Here is the General Sherman Tree, the largest living thing on earth.

Several miles to the northwest of Sequoia is General Grant National Park covering four square miles.

(Continued on next page)



Down the Kings River toward mouth of Boulder Creek. Rugged peaks in limestone formation enhance the picturesque beauty of this canyon.

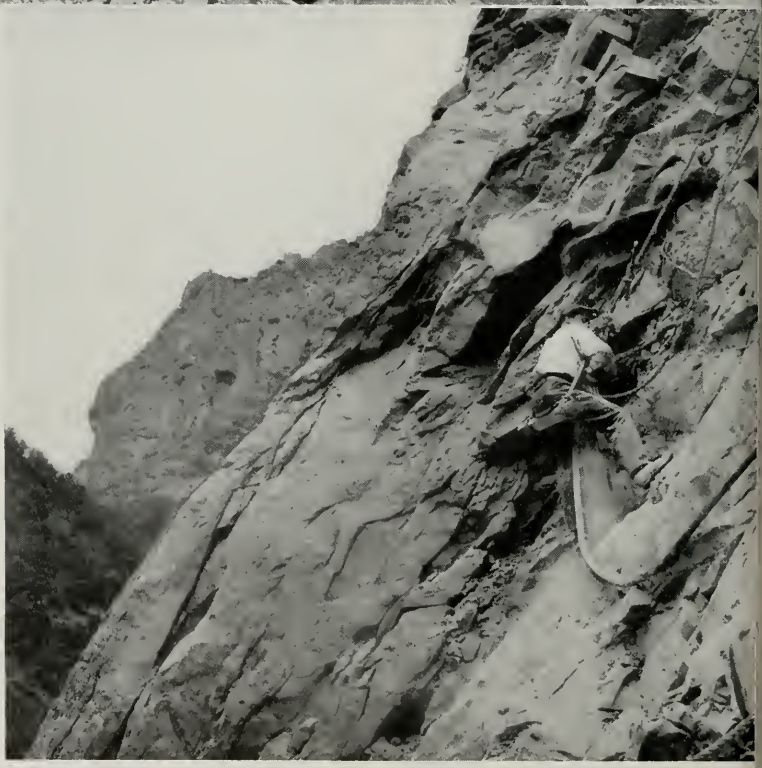
This is the home of the General Grant, the Nation's Christmas tree, towering 267.4 feet. It is the oldest living thing on earth.

Starting from General Grant Park, as one approaches Cherry Gap, he can, on a clear day, see in the distance, a 50 mile section of the San Joaquin Valley. As he passes beyond Cherry Gap he views, for the first time, the rugged beauty of the lower Middle Fork of the Kings. Later at Lookout Point he again sees this view and notes the ruggedness of the country along the South Fork and the relative location of Ten Mile Creek, the two Forks and the main Kings River Gorge.

Yucca Point is immediately above the Forks of the Kings River and from that point on the tourist sees one scenic attraction after another.

A good oiled road has been completed to the Kings River crossing, where a gate prevents the public from following the highway further. At this point the Forest Service maintains a guide to direct tourists, if they wish, to Putt Boyden's Cave, located in the face of Windy Cliff some 200 yards from the crossing. The cave is in a limestone formation and its beauty fully rewards the tourist who climbs the trail to its entrance.

Although the public is not permitted to travel beyond the Kings River crossing, the roadway is roughly finished for approximately



Above—Windy cliff crossing of Kings River; the highway follows the right bank. Steam shovel biting into hard rock. Lower—This cliff face typical of many that had to be blasted.



Parking area at Windy Cliff River crossing on Kings River Highway. A drinking fountain for visitors will be erected here.

four miles above this point and pioneer work has reached Grizzly Creek, some 7000 feet from Deer Cove Creek, at which point the U. S. Forest Service road will begin.

The U. S. Forest Service plans to coordinate its roadway work with that of the State and no doubt will be able to open its road from Deer Cove Creek to Copper Creek and invite the touring public into the Cedar Grove and Copper Creek country at the same time that the State Highway to Deer Cove Creek is made available for public traffic.

The State will complete actual construction on its portion of the highway before November, 1939.

Important Condemnation Decision

By CLARENCE W. MORRIS, Assistant Chief, Division of Contracts and Rights of Way

A RECENT decision of the appellate court of this State ruled for the first time upon a question of vital importance to all governmental agencies engaged in building roads and highways over and upon lands acquired by railroad companies through grants from Congress.

The decision arose in the case of *People of the State of California, acting by and through the Department of Public Works, versus Tulare Packing Company et al., as to defendant Southern Pacific Railroad Company* (reported in Vol. 93, C. A. D., page 217). Among other things it was held that the railroad company, where it has merely a "right of way" over a portion of the lands sought to be condemned, has only an inalienable (nontransferable) title thereto, and is entitled only to compensation for the damage which the use of the property taken by the Division of Highways would cause to the right of use of the railroad company.

OWNERSHIP DISPUTED

This action in condemnation was brought against the Southern Pacific Company to condemn a right of way for a new State highway across lands owned by the Southern Pacific Company lying within the city limits of Tulare. At certain places where the new highway was located, the ownership of the land was claimed by the Southern Pacific Company.

The Southern Pacific Company acquired this land as "Congressional grant land" under Secs. 2 and 3 of an Act of Congress approved July 27, 1866 (14 U. S. Stats. 292). Substantially all of the congressional grants have two important sections therein, one of which (Sec. 2) grants to the railroad company, in consideration of its constructing and maintaining a railroad, an easement for right of way and for station grounds, etc., the same being a certain specified number of feet in width; while the other section (Sec. 3) grants to the railroad company in fee, as a bonus, a certain number of alternate odd numbered sections extending out a specified number of miles on each side of the railroad right of way.

The subject case involved an interpretation of Secs. 2 and 3 of a con-

(Continued on page 20)



View of section of new link of Orange Belt Highway constituting wide northern gateway to City of Porterville.

Porterville Opens New Highway

By C. F. WAITE, District Office Engineer

AN IMPORTANT major link in the Orange Belt Highway, State Sign Route 65, that ultimately will extend from Bakersfield north to Sequoia and General Grant National parks, through the east side of Tulare county, the new mile-long highway constituting a broad northern entrance into the City of Porterville was officially dedicated on June 16th.

Officials of the State and of Tulare and Kern joined with civic leaders and citizens of these two counties in a celebration that hailed completion of another section of the Orange Belt Highway, an undertaking into which the communities of eastern Tulare have put ten years of effort.

The Porterville link will be an integral part of an agricultural and recreational route on which the roadway between Strathmore and Lindsay already has been standardized.

Following a luncheon tendered to 400 representatives of highway minded groups by the Porterville Women's Club and official opening of the new construction by Director of Public Works Earl Lee Kelly, representing Governor Frank F. Merriam, a meeting was held at which officials of the State Department of Public Works, the California Highway Commission and of Tulare and Kern counties discussed plans for the future development of the Orange Belt Highway.

At this conference it was the concensus that the building of the remaining portion of the east side highway will have to be placed on a two-biennium basis; that the section between Bakersfield and Porterville will have to be constructed in sections over a four years period and linked into one direct route from Bakersfield north to Ducor, Terra Bella and Porterville where it will join the Porterville stretch and go on to Strathmore, Lindsay, Exeter and Woodlake and points to the north. Director Kelly announced that a reconnaissance survey of the project will be undertaken as soon as possible by the Division of Highways and said that Kern County, making use of available Federal and State funds, would be prepared to build ten miles of the southern portion of the highway on whatever line is approved by the engineers of the Division of Highways. Kern County officials promised whole-hearted cooperation.

The Porterville reconstruction, which is 0.86 of a mile in length, between Morton Street and Mulberry Street, lies partly within the city of Porterville, 0.65 mile, and partly without, 0.21 mile, and provides an excellent entrance to the city from the north. Two curves of long radius are substituted for three on the old alignment, one of which is a right angle turn, and another a turn of almost a right angle.

Two thousand feet of the southerly end of the project within the city was graded full width of the right of way, while the balance of the project is graded to a 36-foot width between shoulders. Soil conditions were adverse on the greater part of the project, and imported borrow and imported surfacing material were brought in for the top layers. The pavement is plant mix surfacing on crusher run base 22 feet in width. The shoulders were given a road mix surface treatment full width.

Bids were opened on March 16, 1938, and the date of completion as set by the contract was August 1, 1938. N. M. Ball Sons, of Berkeley, were the successful bidders. The work has been very efficiently and successfully prosecuted to the end that the project was completed some 45 days ahead of schedule.

The cost of this improvement is $41,296.

Irving T. Ball was superintendent for the contractor, while C. F. Oliphant was Resident Engineer for the State.

Speaking at the luncheon and at the dedication ceremony, Director Kelly, aware of the importance to Tulare County of the Central Valley Water Project, said that this huge water conservation undertaking and the building of highways in Tulare and Kern counties are closely allied. He pointed out that when the Central Valley Project is completed, the new highways constructed in Tulare last year, this year, and to be built in the future will directly serve the increased motor vehicle traffic through this wealthy agricultural region.

WITH state officials and civic leaders guests of honor, Porterville dedicates to public use the new, mile-long highway connection that gives the community a wide northern gateway to motor traffic, and constitutes one of the major links in the eastside short route from Bakersfield and the south to the Sierra Playgrounds of Sequoia National Forest, Sequoia National Park and General Grant National Park.

Planned and worked for for years by communities of the east side of Tulare county, from Ducor on the south to Woodlake on the north, the short route some day will provide a direct passage way for the varied agricultural products of an immense area, to the great cities of the southern part of the state, and a tourist route that will draw thousands from those same cities to summer and winter vacation areas of the Sierra.—*Porterville Recorder.*

Representing the California Highway Commission, of which he is chairman, H. R. Judah of Santa Cruz spoke briefly at the luncheon and also at the dedication.

"The State Highway System," Mr. Judah said, "is one of the best, if not the best, investment the people of California ever have made. It was built largely with gasoline tax funds, as was this project of yours. The gas tax is not a tax; it is an investment."

Emmett R. Berry acted as chairman of the luncheon meeting and Assemblyman Ford A. Chatters of Lindsay was master of ceremonies. Short talks were made by Harry A. Hopkins, Assistant Director of Public Works; R. M. Gillis, Construction Engineer; E. T. Scott, District Engineer; W. R. Woollomes, Chairman Kern County Board of Supervisors; Highway Commissioner William T. Hart of Carlsbad; Carl E. McStay, Automobile Club of Southern California, and others.

Director Kelly and other speakers paid high compliments to State Senator Frank W. Mixter of Exeter and State Senator J. I. Wagy of Bakersfield, who were at the speakers' table, for the years of cooperation they have given to the Central Valley Project and the highway program.

(Continued on page 25)

Director of Public Works, Earl Lee Kelly, officially opens new Porterville Highway. Front row, left to right—J. G. Brown, Plano; Assistant Director of Public Works Harry A. Hopkins; H. R. Judah, Chairman, California Highway Commission; Miss Joan Berry; Director Kelly; Miss Betty Jones; Highway Commissioner, Wm. T. Hart; F. M. Pfrimmer, Porterville City Manager. Rear row, left to right—W. R. Woollomes, Chairman, Kern Board of Supervisors; C. B. Allumbaugh; R. M. Gillis, Construction Engineer, Division of Highways; J. R. Fauver, Exeter; E. T. Scott, District Engineer; Senator Frank W. Mixter; Reverend J. A. Milligan; Senator J. I. Wagy, Bakersfield.





View of new Webber Creek Bridge on recently completed highway between El Dorado and Clark's Corners, near Placerville.

Pioneer Road Unit Modernized

Several hundred persons who witnessed the official ceremonies attending the dedication of the new stretch of highway on U. S. 50 south of Placerville in El Dorado County saw something novel in the way of ribbon-cutting when Henry Barton, famous pioneer stage driver, drove an ancient stage coach through a ribbon barrier stretched across the recently completed Webber Creek highway bridge on the reconstructed route and Harry A. Hopkins, Assistant State Director of Public Works, whose father freighted bullion from Virginia City to Sacramento in the 70's, riding on the antique vehicle, reached down and snipped the silken strand with a pair of scissors, thereby formally opening the new highway. Mr. Hopkins represented Governor Frank F. Merriam and Earl Lee Kelly, Director of the Department of Public Works.

By HARRY A. HOPKINS, Assistant Director of Public Works

TO AN accompaniment of cannonading in the skies and a lavish aerial electrical display staged by Nature, the newly-aligned section of U. S. Highway 50 between El Dorado and Placerville, washed spick and span and christened by a summer rain, was dedicated to public service on Sunday morning, June 19.

The thunder and lightning and the ensuing downpour failed to dampen the enthusiasm of several hundred citizens of El Dorado County and visitors who participated in the road-opening celebration. As a matter of fact, the brief and unexpected storm added a rather enjoyable interlude to the dedicatory ceremonies.

Opening of the new highway was celebrated exactly eighty years to the day after the first mail coach rumbled into Placerville, then Hangtown, from Sacramento.

Completion of this project marks another step in the improvement of the road between Sacramento and Lake Tahoe, via Placerville. The growing popularity of the Tahoe resorts and the American River recreational area is increasing the use of this road and it is anticipated that as soon as money becomes available other units will be improved until the entire route has been brought up to modern standards of alignment and grade.

In the gold rush days this route, with its stagecoaches and pony express riders, was among the most colorful and romantic on earth.

Following an inspection of the project, a group of official guests was entertained at luncheon at the Hotel Raffles in Placerville. Informal talks were made by Henry S. Lyon, district attorney of El Dorado; Fred C. Tatton of the California State Chamber of Commerce; William Breedlove, chairman of the El Dorado board of supervisors; Mayor George Faugsted, Mayor of Placerville, and others.

Representing the city of Sacramento at the dedication ceremonies were City Manager James S. Dean and Edwin R. Piekett, president of

(Continued on page 16)



This highway crossing Webber Creek replaces old, crooked alignment on U. S. 50 southwest of Placerville.

SOIL STABILIZATION

By THOMAS E. STANTON, Jr., Materials and Research Engineer

The following article is the second part of a paper prepared and presented at a recent meeting of the County Engineers Association of California recently held in San Diego. The first part appeared in the June issue of this magazine.

A SUBJECT by no means new but of recent years all dolled out in new clothes is the subject of "soil stabilization" as now generally understood and which covers the entire field from consolidation of clay and adobe soils at optimum moisture without admixtures to the latest developments in emulsified asphalt and Portland cement soil mixtures.

Soil stabilization as defined by C. A. Hogentogler of the U. S. Bureau of Public Roads is—

> "The process of giving natural soils enough abrasive resistance and shear strength to accommodate traffic or loads under prevalent weather conditions without detrimental deformation. The essential consideration in stabilization is to provide the combination of internal friction and cohesion required to furnish the soil with high shearing strength. It is well known that the denser the soil the greater is its stability. The methods employed include the use of admixtures, compaction and densification by specific technical theory and laboratory control. Optimum water content is fundamental with gradation. Admixtures may be soil materials, deliquescent chemical, solutions of electrolytes, soluble cementitious chemical, primers and neutralizers and insoluble binders."

GENERAL METHODS

The essential features of stabilization include prevention of clay, silt and loamy soils becoming detrimentally wet, incorporation of granular materials in clay soils, furnishing granular soils with cohesive binder, or a combination of one or more of these.

General methods for accomplishing stabilization may be enumerated as follows:

1. Selection of natural soils with granular materials and binder which furnishes high stability.
2. Adding soil binder to granular materials or adding granular material to clays.
3. Treating graded soils with deliquescent materials such as calcium or sodium chloride.
4. Waterproofing soils with bituminous materials.
5. Cement-soils mixtures.
6. Densification of natural soils by special manipulation in combination with admixtures of physical or chemical materials other than soil to eliminate permanently those colloidal and clay properties productive of volume change.

IN NEW FIELD

The term stabilization as applied to items 1 to 5 is simply the application of a new term to methods and processes extending back several generations at least. It has been standard road construction procedure to bind granular materials with clay; dilute clays with granular materials; treat soils with diliquescent salts to eliminate dust; and waterproof and bind granular soils with bituminous materials and Portland cement.

As applied to the stabilization of adobe and clay soils with materials, other than soils, to permanently eliminate those properties productive of volume change we get into a new field; a field in which considerable progress has been made in recent years. It is experience in this last field which will be discussed more at length in this paper.

According to McKesson and Frickstad in a report of a cooperative investigation of intermediate road types, 1927, the use of crude asphaltic base oil and light residuum for the preservation of road surfaces was begun in the western part of the United States forty years ago. One of the earliest detailed reports of oiled road construction in California, prepared by James W. Abbot, appeared in the U. S. Department of Agriculture Year Book of 1902. Mr. Abbott described the construction of six miles of road in Los Angeles County in 1898 where oil was used to lay the dust. Only four years later 750 miles of county roads and city streets had been oiled in 25 counties in California.

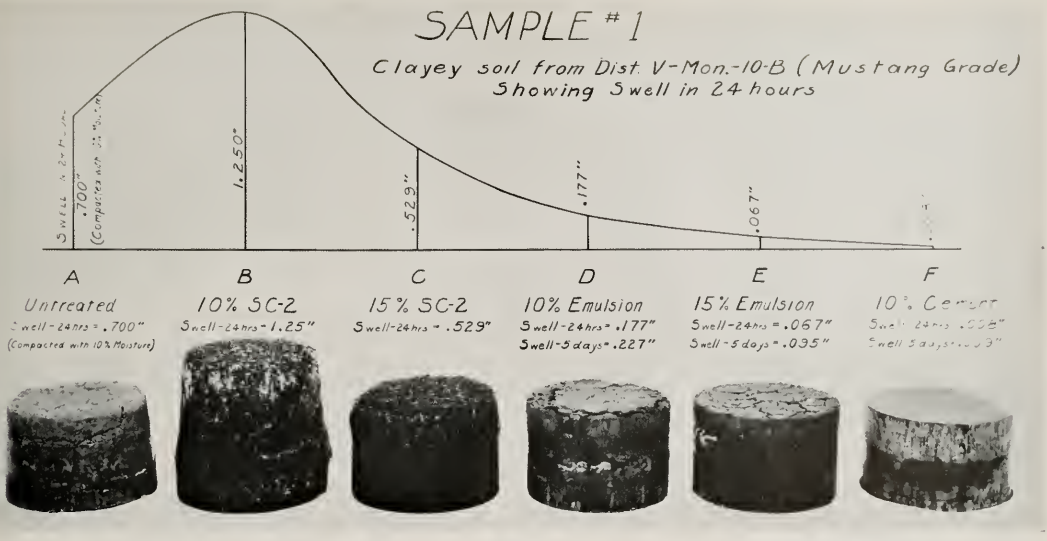
Neglect of maintenance and, in many cases, unsuitable soils were the cause of failure of much of this early oil road construction. The surfaces were presently a mass of chuck holes and corrugations and the roads were rougher riding than if no oiling at all had been done.

LIGHT OIL TREATMENTS

As a result light oil road construction received a black eye in California and it was not until twenty years later that the West began to give serious and systematic attention to this inexpensive type of road surfacing. Oregon had considerable success with surface treatments in 1923 and in 1924 and 1925 California followed suit.

The light oil treatments evolved in Oregon and California were of two types, the surface treatments method, and the surface mixing method. The early Oregon work was confined to the surface treatment method, whereas in California both methods were used, the mixing method gradually acquiring favor over the surface treatment method.

The treatment of metaled roads by the surface mixing process was

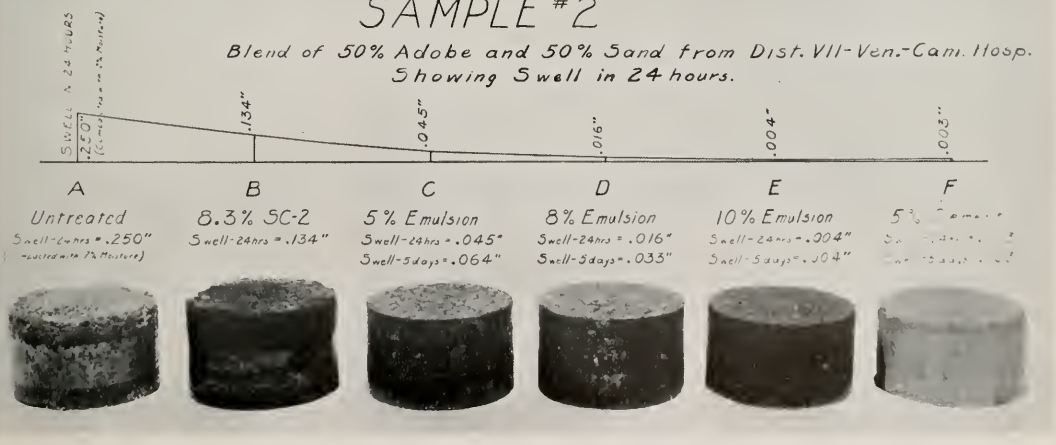


merely a modification of the methods used extensively on natural soil over an extended period in Stanislaus County, California, and other counties of the State. No new principles were introduced but there was a change in construction details. Wisconsin began using the method in 1923, Nevada and Wyoming experimentally in 1925 and California in 1926.

The first oil mix road on the State Highway System in California was constructed in San Bernardino County between Victorville and Barstow in 1926 under the direction of E. Q. Sullivan, District Engineer. The roadbed material was of excellent quality for this type of construction and considerable success attended the work, which is still in fairly good shape after twelve years of service.

The success of the Victorville-Barstow project encouraged an extensive program of this type of construction and approximately three thousand miles of similar construction have been built on the California State Highway system since that date.

In 1929, however, a section constructed that year easterly from Yermo, San Bernardino County, developed distress under traffic in a short time after construction. The Materials and Research Department undertook to determine the cause of the trouble and F. N. Hveem of the



department was assigned to the study. Hveem quickly determined that the local aggregate reacted entirely different in the presence of oil and water than did the aggregate on the Victorville project. It was subsequently learned that the Yermo material had about everything wrong with it that could be wrong with a material of this type.

LESSONS LEARNED

First it was found that even though in the desert, the coarse particles contained sufficient moisture so that in the surface area determination on which the proper oil content is based, the fine dust particles clinging to the coarser particles, were not readily screened through the 200-mesh screen with the result that not enough oil was being used. A mixture which at first appeared rich, quickly dried up and become dead as the oil slowly penetrated the film of fine particles and was absorbed by the rather porous coarser aggregate.

The aggregate had a greater affinity for water than for oil thereby resulting in early failure due to raveling or rutting under traffic. There was likewise a high swell of the mixture in the presence of water, another manifestation of the greater affinity of the aggregate for water than for oil.

From this and similar experiences was developed the clause in our specifications covering the wash test for determining percentage of fines and the water asphalt preferential test for determining the characteristics of the fine aggregate.

ARIZONA EXPERIMENTS

About the same time, Arizona was experiencing similar difficulties with caliche and other typical Arizona soils. Several test methods were devised to detect the suseeptibility of oil roads to moisture conditions. The methods now in use in the laboratory of the California Division of Highways are modifications of methods originally adopted by the Arizona State Highway Department under the direction of J. W. Powers, Materials Engineer.

There are two tests for the purpose. The first, the water asphalt preferential test is made on a sample of dust passing a 200-mesh sieve and determines the water-resisting properties of the filler used in the mixture. The second, the swell test is more conclusive as it is made on a compacted specimen of oil mixed aggregate representing typical proportions of oil or asphalt as well as the grading used in actual construction.

SHOWING COMPARATIVE SWELL OF TREATED AND UNTREATED SOILS OF VARIOUS TYPES

SOIL			SWELL *					REMARKS
No.	Specimen	Treatment	24 hrs.	2 days	3 days	4 days	5 days	
	A	Untr.	.700"					Compacted with 10% Moisture
	B	10% SC2	1.250"					
1.	C	15% SC2	.529"					Clayey material from Dist. V-Mon-10-B (Mustang Grade)
	D	10% Emuls	.177"	.203"	.217	.222	.227	
	E	15% Emuls	.067"	.083"	.090	.093	.095	Equivalent to A-7 Soil in USBPR Class
	F	10% Cmt	.008"	.008	.009	.009	.009	
	A	Untr.	.250"					Compacted with 7% Moisture
	B	8.3% SC2	.134"					Material consists of a blend of 50% adobe and 50% Sand from Dist-VII-Ven. Co.
2.	C	5% Emuls	.045"	.055	.060	.062	.064	
	D	8% Emuls	.016"	.024	.029	.031	.033	
	E	10% Emuls	.004"	.004	.004	.004	.004	Camarillo Hospital. Equivalent to A-6 Soil
	F	5% Cmt	.003"	.003	.003	.003	.003	
3.	A	4.9% SC2	.003"					Sandy Material. Dist. VIII-Riv-26-A. Equiv. A-3 Soil.

* Standard swell test for Bituminous Mixtures. Materials & Research Dept., Cal. Div. of Highways.

PROBLEM OF AGGREGATES

Experience has shown that if filler dust, which has a greater affinity for water than for oil, or aggregate, which has a high swell when mixed with oil and subjected to the swell test, is used in oil road construction trouble may be anticipated and, therefore, our specifications are so written as to eliminate unsuitable material of this type.

In view of the fact that much of the local soil in California fails to pass the water asphalt preferential and swell tests and has been found unsuited for mixing asphaltic oil as evidenced by failure in service, the use of such local materials with oil has been eliminated with resultant higher cost for importing suitable aggregate.

This situation has been the occasion of intense studies both locally and nationally to develop some methods of treating these adverse soils so as to eliminate absorption of moisture through capillarity and consequent swell and disruption.

Two methods have been developed which give considerable promise provided they are found economical of application on specific projects.

EMULSIFIED ASPHALT STABILIZATION

The first method to attain prominence in this field was that of stabilization with emulsified asphalt.

According to the theory of C. L. McKessen:

"Stabilization with emulsified asphalt has three definite objectives:

1. Waterproofing the individual soil particles and thereby rendering the base highly resist-

ant to water which would otherwise be absorbed by capillarity.

2. Forming on the soil particles an absorbed film of hard asphalt, of almost infinitesimal thickness to give high frictional resistance.
3. Obtaining supporting strength on the finished pavement slab by preserving the naturally high cementitious (dry) strength of clay when the pavement is subjected to long continued exposure to water."

That there is considerable merit in the use of emulsified asphalt for stabilization of many soils there can be no doubt judging by laboratory tests and the service of several experimental projects constructed by the Division of Highways.

Too short a time has elapsed, however, to determine the period of years over which this method of treatment will be effective and some soils have been definitely determined as being unsuitable for such treatment.

The economy of the process must be studied separately for each project and comparison should be made with the cost of importing selected material with low swell and high bearing value which can be satisfactorily mixed with the cheaper road oils or cutbacks.

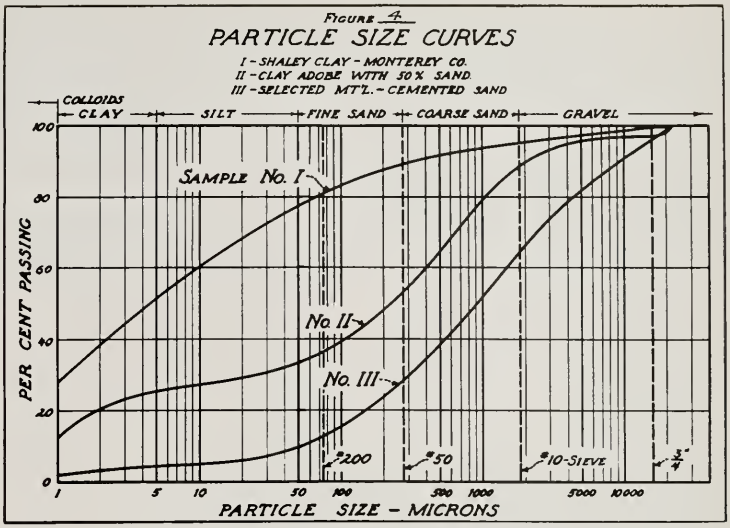
CEMENT SOIL STABILIZATION

A second method of stabilization which has attained considerable attention of late is the Portland cement-soil mix type of construction.

Here as in the case of emulsified asphalt, there is no doubt but that capillarity and swell of many, if not most, adverse soils can be destroyed by admixing Portland cement and then properly consolidating the mixture with the optimum percentage of moisture for the densest compaction.

Several experimental projects of this type have recently been completed or are to be constructed on the California Highway system.

The results to date have been quite satisfactory, although here again, as in the case of emulsified asphalt, the economic factor is an important one. Neither one of these methods of construction have yet been able to compete in cost with oil mix construction where local soil or aggregate suitable for oil mixing is to be found in the finished subgrade under normal construction operations or on a short haul.



It is where the haul and purchase price of imported selected material is high that there may be a real field for the emulsified asphalt or cement-mix type of stabilization and experience may even ultimately determine that the greater serviceable life and traffic carrying ability or stabilized mixes of these types justify their use even in locations where the cost is greater than that of a first class oil or cutback mix job.

Bay Bridge Revenues Decrease

TRUCK traffic over the San Francisco-Oakland Bay Bridge is continuing to increase, according to a traffic report for June filed by State Highway Engineer C. H. Purcell with State Director of Public Works Earl Lee Kelly. However, revenues showed a drop of approximately $8,700 last month compared to May. A total of $369,596.20 was collected in June compared to $378,289.70 in the previous month.

Despite a one-day shorter month, the number of trucks showed a gain of 3064 in June over May, with totals for the two months 35,530 and 32,466 trucks respectively. Truck trailers also increased from 1452 in May to 1588 in June. Number of freight pounds carried over the bridge reached an all-time high with 92,797,000 pounds transported, bringing the total to date to 1,176,231,909 pounds. Tolls and freight rates were lowered on May first from 75¢ per truck to 60¢ and from 3¢ per one hundred to 2¢.

Average vehicles per day also showed an increase, although the total number of vehicles fell below the May figure due to a shorter month in June. Last month's average was 23,806 as compared with the previous month's figure of 23,583. Total number of vehicles was 714,173 for June and 731,079 for May. June traffic brought the total number of vehicles crossing the bridge since its opening November 12, 1936, to 14,511,504.

Comparative figures follow:

	Total May	Total June	Total Since Opening
Passenger automobiles	665,863	641,653	13,522,690
Auto trailers	1,082	1,378	22,622
Motorcycles	2,765	2,736	49,562
Tricars	1,137	1,102	15,122
Buses	11,369	11,273	167,133
Trucks	32,466	35,530	488,951
Truck trailers	1,452	1,588	29,633
Total vehicles	731,079	714,173	14,511,504
Extra passengers	206,252	204,247	3,308,017
Freight lbs.	18,014,417	92,797,000	1,176,231,909

Pioneer Road Unit Modernized

(Continued from page 10)

the Sacramento Chamber of Commerce.

As was mentioned in a previous article in the December, 1937, issue of this magazine, this new construction is approximately 4.3 miles in length, about 1.9 miles shorter than the old route. The new alignment, with a minimum radius of curvature of 1000 feet, eliminates many sharper curves, some with radii shorter than 100 feet.

The surfacing on the project consists of plant-mixed bituminous treated crushed rock, 22 feet wide by 0.25 of a foot thick, on a crusher run base 23 feet wide by 0.4 of a foot thick. The grading and surfacing cost approximately $190,000. The contractor was Hemstreet and Bell and Mr. J. D. Greene and Mr. H. F. Sherwood were the resident engineers for the State.

The Webber Creek bridge, over 100 feet high and 322 feet long, is of the reinforced concrete girder type. A graceful span, blending well with the surrounding country, it was built concurrently under a separate contract at a cost of about $41,000. The contractor was the Campbell Construction Company and the resident engineer for the State was Mr. J. H. Horn.

Contract for 75,000 Barrels of Cement

Bids were recently opened in Washington, D. C., for 75,000 barrels of finely ground standard portland cement for Central Valley Project construction.

This is the largest cement order to date on the Central Valley Project. The cement will be used for work on the Kennett and Delta Divisions, with 30,000 barrels destined to Coram and 20,000 barrels to Redding, in Shasta County, and 13,000 barrels to Antioch and 12,000 barrels to Neroly, in Contra Costa County.



Harry A. Hopkins, Assistant Public Works Director, assisted by Ed Willis, Highway Maintenance Superintendent, snips ribbon barrier on new Placerville Highway as Henry Barton, pioneer stage driver, drives ancient stage coach through it.

New Foothill Highway Link Is Dedicated

By A. EVERETT SMITH
Assistant Highway Engineer

AMID a picturesque and historical setting on June 3, Governor Frank F. Merriam, accompanied by Earl Lee Kelly, Director of Public Works, and Harry A. Hopkins, Assistant Director of Public Works, dedicated the final link of the four-lane Foothill Boulevard to the use of the traveling public.

The dedication was held beside the Madonna of the Trails statue located at the intersection of Euclid Avenue, nationally famed for its beauty, and the Foothill Boulevard which carries a large volume of business and recreational traffic and is especially noted as the longest four-lane highway in California.

Following an address given by Governor Merriam, who was introduced by C. E. Grier, chairman of the county board of supervisors, a short talk was given by Director Kelly. Other speakers for this occasion were Godfrey A. Andreas, Assemblyman; Dr. C. G. Houston, Director of California Safety Council; Franklin Lowney, Executive Vice President of the Safety Council; E. Q. Sullivan, District Highway Engineer; and J. B. Gill, President of the Foothill Boulevard Association. Rollin L. Leman, President of the Upland Chamber of Commerce, presided.

Completing his address, Governor Merriam symbolically opened the highway to a new era of traffic when he walked to the center of the boulevard and clipped a ribbon barrier. Thus, with years of planning and building, this route has advanced from a mere farm road to a modern, four-lane, divided highway.

This final link of the four-lane Foothill Boulevard extends from the Los Angeles County line at Claremont easterly over Highway Route 66 to San Bernardino, a distance of twenty-one miles. The contract covering this improvement is in the final stage of construction. The work is being done by the United Concrete Pipe Corporation, contractors, under the inspection of J. M. Hollister, resident engineer.



To obtain this width of highway, the existing asphaltic concrete pavement, completed to a thirty-foot width in 1929, was by this project widened to a width of forty-six feet by placing an additional sixteen foot width of asphaltic concrete pavement. The forty-six foot width of surface bears two eastbound and two westbound traffic lanes, the two inside lanes being separated by a central dividing strip four feet in width, in line with recent State highway practice in constructing four-lane, divided highways. Each inside lane is eleven feet in width, and each outside lane is ten feet in width bordered by an eight-foot shoulder of oiled road-mix surface treatment.

The placement of the additional sixteen-foot width of pavement and shoulder construction necessitated the extension of numerous existing corrugated metal pipes, reinforced concrete box culverts, and reinforced concrete bridges.

Greatest care was used in the design to avoid cutting down trees. Three hundred palm trees were removed and replanted where they were too close for safety. Pavement widening was designed for placement on alternate sides of the existing pavement in such manner as to preserve the magnificent palm and eucalyptus trees that adorn this highway, without seriously sacrificing standards of alignment.

At areas where curbs were constructed, the distance from center line to curb was increased approaching street intersections to give a maximum of visibility at these points.

Intersections from side roads were paved to give free access to the highway and to prevent mud from being tracked onto the highway, thus guarding against it being slippery in wet weather.



Governor Frank F. Merriam, with Director of Public Works, Earl Lee Kelly, J. B. Gill, and little Joan Andreas, dedicates new four-lane link of Foothill Boulevard, shown above. This route will provide a means of rapid transportation between the Los Angeles Metropolitan area and San Bernardino, from which point transcontinental highways pass through the Imperial Valley, the Colorado Desert, and the Mojave Desert. Also, from this point, roads lead directly to the popular mountain resorts located nearby. Lower photo courtesy Los Angeles Examiner.

Decrease of $4,300,000 in Federal Aid to California Highway System

By R. F. REYNOLDS, Assistant Office Engineer

PRESIDENT ROOSEVELT signed the Federal Aid Highway Act of 1938 on June 8. This act authorizes the expenditure of $349,500,000 in Federal aid to the states and territories for highways during the two fiscal years between July 1, 1939, and June 30, 1941.

Funds appropriated by Congress under this act provide the following amounts for the several road classifications eligible for expenditure of Federal money:

Regular Federal Aid	$215,000,000
Sec. or Feeder Roads	30,000,000
Grade Cross. Elimination	50,000,000
Public Lands	3,000,000
Forest Highways	23,000,000
National Park Roads	23,000,000
Indian Roads	5,500,000
	$349,500,000

California will receive a total of about $13,500,000 from these Federal funds for highway construction for the two fiscal years ending June 30, 1940, and June 30, 1941. Of this sum approximately $11,350,000 will be expended under the direct supervision of the California Division of Highways for construction of highways and bridges and the elimination of hazards at railroad grade crossings.

The sums authorized for apportionment to California by this act are approximately $4,300,000 less than the total sums which previously were allocated for the two fiscal years ending June 30, 1938 and 1939.

The effect of this $4,300,000 decrease in Federal apportionments will necessitate the curtailment of an equal amount of important highway construction and grade crossing elimination.

The action of Congress in decreasing Federal authorizations for highway construction was mainly brought about by the apparent inability of the majority of states and territories in the Union to promptly expend previous Federal apportionments. In this regard, figures released by the Bureau of Public Roads on April 30, 1938, showed that all but eight states out of the total of fifty states and territories had balances of regular Federal aid available for programmed projects in an amount in excess of their latest apportionment of regular Federal aid for the fiscal year ending June 30, 1939.

CALIFORNIA AHEAD OF ALL STATES IN NUMBER OF MOTOR VEHICLES

At the close of 1937, California led all states in the Union in the number of registered motor vehicles of all types and in the number of pleasure motor vehicles registered, according to Howard Deems, Registrar of the State Motor Vehicle Department

New York dropped into second place last year on the basis of these comparable figures:

	New York	California
All types of registered motor vehicles	2,640,678	2,657,233
All types of registered pleasure cars	2,207,906	2,319,341

Deems received his New York figures from Commissioner Hartnett of the New York State Motor Vehicle Department.

CALIFORNIA'S POSITION

Of these eight states, California ranks first, in that its available unobligated regular Federal aid amounted to only 70 per cent of the total for the fiscal year ending June 30, 1939, and with approximately a similar percentage of time remaining before the 1940 apportionment of regular Federal aid will become available.

This would indicate that by January 1 of 1939, California will have obligated all of its regular Federal aid and will be awaiting the next apportionment provided by the Federal Aid Highway Act of 1938.

It is also contemplated that before the expiration of the fiscal year ending June 30, 1939, California will have obligated its entire apportionment of secondary or feeder funds, Federal aid grade crossing elimination funds and public lands funds and be in a position to immediately place under way projects to be financed from these apportionments.

A comparison of the funds allocated under the Act of June, 1938, with those previously granted to this State by the Act of 1936 is shown in the following table:

	Totals for fiscal years Ending June 30, 1938 and 1939 apportioned	Totals for fiscal years ending June 30, 1940 and 1941 estimated
Regular Federal Aid Funds	$9,593,488	$8,100,000
Secondary or Feeder Funds	1,918,698	1,140,000
Grade Crossing Elimination Funds	3,700,209	1,825,000
Public Lands Funds	474,837	287,000
Total	$15,687,232	$11,352,000

In addition to the above, the estimated apportionment for California's Forest Highways in amount $1,810,000 is a reduction of approximately $400,000 below the total sum of $2,200,000 as received for the fiscal years ending June 30, 1938 and 1939.



Vanguard of automobile caravan at dedication of Atascadero-Morro Bay Highway in San Luis Obispo County.

Open Atascadero-Morro Bay Highway

By EDWARD J. NERON, Deputy Director of Public Works

AT 11:00 O'CLOCK on June 19th, in San Luis Obispo County, there was held in beautiful Atascadero Creek Canyon, the dedication celebrating the completion of the Atascadero-Morro Bay highway on Route 125.

This road crosses through a low gap in the Santa Lucia mountains over one of the most accessible passes in that range. The ceremony was held at one of the several bridges crossing Atascadero Creek and was organized under the joint auspices of the Morro Bay and Atascadero chambers of commerce.

Dr. Victor Ward of Atascadero was master of ceremonies which were opened by introduction of State and county officials and of citizens who had played their part in the attainment of this highway. Chairman H. R. Judah of the California Highway Commission made the principal address and, following a talk by State Senator Chris Jespersen, Mr. Judah, assisted by two charming bathing maids of Morro Bay, Miss Evelyn Young and Miss Peggy Price, cut the ribbon barrier and formally opened the highway to the public.

DIRECT ROUTE FROM VALLEY

This section of highway (U. S. Route 466) lies between the main coast road between San Francisco and Los Angeles, U. S. Route 101, and the scenic coast road between San Luis Obispo and Monterey, the Roosevelt Highway. It also affords the most direct route from the populous portion of San Joaquin Valley to the ocean, particularly from that area in Fresno, Tulare, King and Kern counties. With the further improvement of the highway leading to the valley, this route is destined to become very popular with the valley residents.

The present contract has a length of 2.8 miles and was constructed at a cost of $155,000. It has a roadbed width of 26 feet with a roadmix type of surface. There are three bridges on the project. The minimum radius of curvature is 350 feet with a maximum gradient of 7%. Because of the very crooked alignment of the road which is replaced, there is a saving in distance of 1.1 miles. There has been previously expended on the highway between Atascadero and Morro Bay the sum of $230,000.

SCENERY PRESERVED

In the location of the highway, particular attention was given to the preservation of natural scenery along the route. Alignment and grades were so established as to make accessible the many picnic and recreational areas along Atascadero Creek.

Widened right of way was obtained at such points by donations from San Luis Obispo County, the Atascadero Development Association and private citizens, thus preserving to the public for all time these very attractive parks. Geo. K. Thompson & Co. were contractors and the road was built under the supervision of H. J. Doggart, Resident Engineer.

(Continued on page 25)

Important Condemnation Decision

(Continued from page 7)

gressional grant, and it was necessary to determine: Whether the railroad company was entitled to compensation equal to the current market value of adjoining properties for that portion of the railroad right of way and station grounds, etc., which was sought to be condemned, or damages based on the extent of interference with the right of use of the railroad right of way by the vehicular highway.

The appellate court decided that portions of the lands sought to be condemned were parts of the Southern Pacific right of way and station grounds extending southerly from Goshen Junction through the city of Tulare, in Tulare County. It was further found that the grant by Congress to the Southern Pacific Railroad Company covered bonus lands and right of way which lay in Sees. 3 and 11 in the city of Tulare. The grant of the railroad right of way also carried with it additional lands to be used for station grounds, machine shop, roundhouse, water tanks, and other adjuncts necessary to maintaining and operating a railroad. The areas to be occupied by these latter appurtenances were never definitely defined by the congressional grant or the maps used in conjunction therewith. As a result it was impossible to determine the extent or area of the station grounds, machine shop and roundhouse reservation in relation to the right of way.

STATE'S CONTENTION

The State maintained that the railroad company had merely an easement or limited fee made on an implied condition of reverter in the right of way, as well as in the station grounds, machine shop and roundhouse reservation, and therefore could not alienate said lands to other than highway departments. The situation was further complicated by the fact that the railroad company had been granted a land patent to the aforesaid odd-numbered bonus sections 3 and 11, and the railroad company maintained that the patent vested a "fee" rather than an "easement" in the railroad right of way, station grounds, machine shop and roundhouse reservation, which the land grant overlapped.

The appellate court held that the railroad company acquired title to its right of way and station grounds in the city of Tulare under the act of Congress, and that its title was of limited fee made on an implied condition of reverter; that the subsequent patent to the two odd-numbered sections added nothing to the estate it held in the right of way and station grounds, and that the land described in the patent not within the right of way and station grounds was owned by the railroad company in fee simple with all of the rights of private ownership.

COURT'S FINDINGS

The court further found that the railroad company was entitled to the reasonable market value of the property taken which was owned in fee by the railroad, but as to the property which the railroad company did not own in fee (railroad right of way, station grounds, etc.) it was entitled only to compensation for the damage which the use of the property taken by the highway department would cause to the right of way use by the railroad company.

The instant case is one where the right of way sought to be condemned lay parallel to and extended longitudinally with the railroad right of way, and this court held, as in the previous case of City of Los Angeles vs. Allen, 32 C. A. 553, that the right to condemn longitudinally is very different from the mere right to cross, for in the one case the rights of the railroad company may be materially impaired, while in the other, the taking is such that both uses can stand together. The railroad company, therefore, was entitled to have the court determine the amount of compensation for the diminution in value, if any, of the railroad company's right of way where the property is subjected to a concurrent use for both vehicular and railroad traffic.

This case was handled throughout by two members of our legal staff, Lincoln V. Johnson and Holloway Jones, and they are entitled to a great deal of credit for developing the point upon which the decision was based.

Gas Tax Diversion Costs Bay State Loss of $472,862

THE Department of Agriculture has announced its finding that Massachusetts has diverted State motor vehicle revenues to other than highway purposes in such manner as to make necessary the withholding of $472,862 of the Federal-aid apportionment of $3,171,423 for the fiscal year ending June 30, 1938.

This action is made mandatory by the Hayden-Cartwright Act of 1934 which requires that Federal-aid funds be withheld from any State using the proceeds of State motor-vehicle registration fees, gasoline taxes and other special taxes on motor-vehicle owners and operators for other than highway purposes in an amount greater than was being so used prior to June 18, 1934. The amount to be withheld may not exceed one-third of the apportionment for any fiscal year.

Massachusetts authorities were notified in October, 1937, that a study of the State's disposition of motor vehicle revenues disclosed an increased use for non-highway purposes subsequent to June 18, 1934. The State was called upon to show why a penalty should not be applied. A showing that could be accepted under the provisions of the law has not been made and the funds in question have not been restored for highway use.

Under similar circumstances $250,000 was deducted from the apportionment to New Jersey for the fiscal year 1937. Maryland, Pennsylvania and Georgia were found to have used motor vehicle revenues for non-highway purposes to such an extent as to require Federal action. Maryland and Pennsylvania have restored the required amounts to highway funds and no further action is to be taken. Georgia officials have given assurance that they will follow a similar course but have not yet done so.

PAN AMERICAN ROAD CONGRESS

Elaborate preparations are being made in Santiago, the Capital of Chile, for the Third Pan American Road Congress to be held in that city during the first two weeks in September of this year.

Chile is one of the most progressive of the South American republics in the development of its highway system and especially of its portion of the Pan American Highway.



City of Petaluma, California

June 15, 1938.

Col. Jno. H. Skeggs,
District Engineer,
Division of Highways,
State Building,
San Francisco, California.

Dear Sir:

May I take this opportunity of telling you how pleased the citizens of Petaluma are with the marking of Route No. 101 through this city.

The work was accomplished with courtesy and precision, and with a minimum of inconvenience to our local people and the traveling public. Mr. Nelson had his crew of painters commence their work at daylight, marking all of the business district during the hours when traffic was light. The pedestrian marking was done under the supervision of Mr. Moore of the maintenance division and that work was also carried on most efficiently.

Since the lines have been painted, giving four lanes for traffic and two for parallel parking, we notice that the through traffic has been handled much more efficiently, there being no congestion in the city, even over the last week end when traffic was heavy. This is most gratifying to us and I know it will be to your department.

There has been so much favorable comment since the painting of the traffic lines that I just wanted you to know that the public does appreciate the work of the organization under your jurisdiction.

Sincerely yours,

(Signed) J. S. WOODSON,
Mayor, City of
Petaluma.

UNITED STATES POST OFFICE
Coachella, California

California Highway and
Public Works
P. O. Box 1499
Sacramento, Calif.

Gentlemen:

I would be very much pleased if you will place my name on your mailing list for your magazine "California Highways and Public Works."

I find the magazine very interesting and of an educational value as to what benefits we are getting from the department.

Thanking you, I am

Very truly yours,
W. R. McCutchen,
Postmaster, Coachella, Calif.

Bank of America

San Diego, California,

California Highways and Public Works
Journal,
P. O. Box 1499,
Sacramento, California.

Dear Sir:

For the last two years, I have been fortunate in receiving the monthly magazine of "California Highways and Public Works." May I at this time express my sincere thanks and appreciation for this courtesy shown to me.

You have a splendid magazine. It is historical, educational and is far reaching in acquainting the public of the developments of California's highways and natural resources.

The magazine has been very helpful to me in presenting views of California's growths.

Thank you again, and wishing you every success, I remain,

Sincerely yours,

(Signed) A. V. MAYRHOFER,
Assistant Vice President.

Berkeley, California,

California Highways and Public Works,
Sacramento, California.

Gentlemen:

Through the courtesy of an engineer friend of mine, I have been receiving your magazine for the past several months and I wish to take this opportunity to thank you and express my appreciation for your publication.

Of the many magazines that I read, I really look forward to receiving the "California Highways and Public Works" each month.

The photography in particular is excellent and I believe your magazine to be one of the best edited.

Yours very truly,

(Signed) R. P. NEWCOMB.

A. Russell Berti

California Highways and Public Works,
Department of Public Works,
Sacramento, Calif.

Gentlemen:

Will you please put me on your mailing list for your publication, California Highways and Public Works.

I intend to use it in my work in the Department of Economics at the University of San Francisco.

Sincerely,

(Signed) A. RUSSELL BERTI.

Redlands Horticultural and Improvement Society

Redlands, California

Mr. E. Q. Sullivan,
District Highway Engineer,
San Bernardino, California.

My dear Mr. Sullivan:

On behalf of the Redlands Horticultural Society and the Beautification Committee of the Redlands Contemporary Club, we with to express our appreciation of the manner in which the widening of the Foothill Boulevard is being carried on. It is a pleasure to all of us who travel on the highway to see the noble ranks of trees, left intact to give continued shade and beauty; and to find in the road occasional graceful curves to break the monotony of the straight-away.

Too often, necessary road improvements have been made at the unnecessary sacrifice of the beauty of the landscape. You are achieving a happier result.

Very sincerely yours,

EDWARD H. BRENAN,
President

KATHERINE FIELD HOTCHKISS,
Corresponding Secretary
Redlands Horticultural Society.

BELLE B. DIBBLE,
Chairman

EDITH A. FINLAY,
Co-Chairman
Beautification Committee of the
Redlands Contemporary Club.

UNIVERSITY OF CALIFORNIA AT LOS ANGELES

Editor,
California Highway and Public Works,
Sacramento, California.

Dear Sir:

Thank you for your generous response to our request to be placed on your mailing list for California Highway and Public Works. This periodical will indeed be a valuable addition to our collection and we shall look forward to receiving the monthly issues.

Very truly yours,

EVELYN HUSTON, LIBRARIAN,
Bureau of Governmental Research.

Father: (after son had taken enormous bite) Another bite like that and you'll leave the table.

Son: Another bite like that and I'll be through.

Flood Damage in Modoc County Prevented by State Engineers

By T. R. SIMPSON, Senior Hydraulic Engineer

THE severe floods and tremendous run-off during the winter of 1937-38 caused mounting hazards to life and property in Modoc and Lassen counties during last May. Several full reservoirs had yet to stand the load from spring thaws of melting snows from high mountain ranges. The most serious threat in this locality was the filling of the Tule Lake Reservoir and the impending failure of the Cedar Creek levee, which in turn rendered unsafe the West Valley Dam located downstream therefrom in the Pit River watershed.

The United States Forest Service established a portable radio broadcast and receiving station at the Cedar Creek levee on Tule Lake Reservoir as soon as the dangerous condition was discovered. Another broadcast and receiving station was installed at the Madeline Tunnel Portal on the reservoir and the station at the Forest Service warehouse in Alturas was kept open at all hours to receive and send messages to the reservoir. All residents in the vicinity of Alturas who had ordinary short wave receiving sets kept tuned in on the progress reports that were made hourly.

RADIO BROADCASTS

These radio broadcast stations were installed primarily to give rapid warning to the residents in the danger zone in case it was necessary to evacuate the area. The State Highway Patrol had an officer stationed at the West Valley Dam to look for any sudden rise in the water flowing through the spillway. The storage capacity in the West Valley Reservoir above the spillway crest would probably absorb the load, in the event of failure of the Cedar Creek levee, for at least two hours before overtopping the West Valley Dam.

Several residents of South Fork Valley walked and rode horseback to inspect the Cedar Creek levee prior to the arrival of dirt-moving equipment on the job. They considered the conditions so threatening that children were withdrawn from school and kept on high ground. Many thousands of livestock were moved from the lowlands and the city of Alturas was a buzzing hive for a few days with a large portion of the populace ready to stampede on slight provocation.

Tule Lake Reservoir occupies the site of an old lake in the northerly portion of Lassen County within the Pit River stream system. Prior to last winter, the east shore of the lake was separated from the channel of Cedar Creek by a low divide, or lip, about six feet high and 200 yards wide. The lake, which has a watershed of 34 square miles, naturally tributary thereto, has never filled and spilled over the lip into Cedar Creek since the time of settlement, more than 50 years ago.

50-YEAR OLD DAM

The natural inflow into Tule Lake normally evaporates each year leaving a natural meadow on the lake bed embracing nearly 2000 acres. The natural water suply, however, was inadequate to insure a good crop of meadow grass each year. Consequently about 50 years ago the water supply was augmented by diversion from Cedar Creek by means of a dam and canal leading on a slight grade over the east lip into the lake.

The Tule Lake Ranch was converted into a reservoir in 1902 by means of an earth levee 600 feet long constructed aeross Cedar Creek a short distanee below the old diversion canal. The levee was higher than the east lip of the lake and was constructed for the purpose of diverting all surplus waters of Cedar Creek over and above the capacity of the canal into Tule Lake. This resulted in 46 square miles of additional watershed being made tributary to the lake. At the same time a tunnel was commenced through the west lip of the lake and completed two years later. The tunnel serves to release water from the lake for irrigation purposes on 1400 aeres in the vieinity of Madeline, which area is within the Great Basin and outside the watershed of Pit River.

TREMENDOUS RUN-OFF

The flood in December, 1937, eroded away the east lip of Tule Lake and allowed the waters therein to back up against the Cedar Creek levee. The tremendous run-off during the winter of 1937-38 from the tributary watershed had filled the lake to a depth of 14 feet representing a storage of 35,000 aere feet early in May. The Cedar Creek levee is in a remote and inaccessible locality and no one ever goes there during the winter and spring seasons. It had never occurred to anyone that high water might be a souree of danger in this area because the reservoir had never been more than half full even after an accumulated catchment of three years water supply in comparatively wet years from 1902 to 1905.

The dangerous condition of the Tule Lake Reservoir was accidentally discovered by a range rider several miles away who happened to have a view of it from a higher elevation on the Warner range of mountains. He immediately informed the South Fork Irrigation District of the advisability of an inspection of the Cedar Creek levee. The irrigation district owns the West Valley Reservoir to which Cedar Creek is tributary about 8 miles below Tule Lake Reservoir. Three of the landowners in the district made an inspection of the Tule Lake Reservoir on May 6th. A night letter was received from them the following morning by the State Engineer requesting an immediate inspection of the alarming appearanee of the Cedar Creek levee. The owner of the reservoir is away on a tour of Europe.

The writer, who was in Alturas at that time on adjudieation and water distribution work for the Division of Water Resources, was contaeted by



View of new Tule Lake Reservoir levee which was raised six feet under emergency construction to prevent its destruction and consequent wiping out of West Valley dam and flooding of Alturas.

telephone and dispatched to make an immediate investigation to determine if an emergency existed on Tule Lake Reservoir.

It was found that the freeboard between the top of the Cedar Creek levee and the water level in the reservoir ranged from only 8 to 16 inches. The total inflow into the reservoir at that time was 10,500 miners inches and no water was running out. It was discovered that there were two cave-ins of the old timbered section of the Madeline Tunnel that had the outlet portal completely blocked Also the shaft down to the outlet gate at the intake portal of the tunnel had caved in and was filled with debris. There was thus no way of immediately releasing any water from the reservoir which was not equipped with a spillway.

DANGEROUS CONDITION

From snow surveys that had recently been made on the Warner range of mountains, an additional run-off of about 8000 acre-feet was to be expected from melting snow on the 80 square miles tributary to Tule Lake Reservoir before the close of the current run-off season. It was also probable that additional run-off would occur from storms during the remaining period of flow from melting snow. It appeared certain from the existing inflow onto the six square miles of water surface covered by the reservoir that the Cedar Creek levee would be overtopped with water within a week even with the outlet tunnel releasing at full capacity of 3000 miners inches.

The West Valley Reservoir, into which the Tule Lake Reservoir would empty in the event of failure of the Cedar Creek levee, was filled to capacity of 18,000 acre-feet and water 18 inches deep was running through the spillway. The West Valley spillway has a capacity of about 300,000 miners inches, but it was never designed to carry the load of failure of the Cedar Creek levee. The Cedar Creek levee, was constructed of loose material, had more than 100 leaks along the base of the fill, each about the size of a pencil.

It was possible for the entire levee to sluice away in a short time if it was overtopped with water, thus releasing a stream 600 feet wide and about 10 feet deep into the West Valley Reservoir. Such a load would certainly overtop the West Valley Dam several feet. The West Valley Dam, which is 60 feet high, is an earth-fill structure and of course was never designed to be overtopped with water.

EMERGENCY WORK STARTED

The channels of South Fork of Pit River and of Pit River between Likely in Modoc County and Muck Valley in Lassen County were already filled and overflowing with some resultant property damage during the first two weeks in May. The release of any additional stored water at that time would have caused heavy property damage. A sudden failure of the Cedar Creek levee and the simultaneous failure of the West Valley Dam would cause a disaster too terrible to contemplate in the grave hazard to the lives of the residents along the valley floor in Modoc and Lassen Counties, including the Towns of Likely, Alturas, Canby, Lookout, Bieber and Nubieber and possibly even farther downstream.

Work was commenced immediately on clearing the Madeline Tunnel which was opened in 48 hours at full capacity. However, the inflow into the reservoir was more than three times the rate of release. It was not known as to whether it was even possible to push through to the Cedar Creek levee with a caterpillar and heavy dirt-moving equipment due to the rough terrain with numerous marshy spots to cross. However, it was necessary to get such equipment on the job in order to move 15,000 cubic yards of earth onto the levee within the limited time available to relieve the emergency.

C. C. C. GIVES AID

A six-horse team with a plow and scraper was immediately sent to the levee to commence filling in the low places. The services of the Juniper Flat C. C. C. Camp near Likely were enlisted in the emergency. This camp

(Continued on page 25)



This photograph of Big Creek bridge on Carmel-San Simeon Highway shows unique type of construction.

Big Creek Bridge Is Unique

F. W. PANHORST, Bridge Engineer

AN UNUSUAL BRIDGE is now being built at Big Creek on the San Simeon Highway about fifty miles south of Carmel.

This bridge is unusual in that the end spans, or arches, are held back by the main portion of the bridge and are not supported by the ground.

At the point where Big Creek empties into the ocean the highway grade is about 90-feet above the bed of the creek. To span the canyon a bridge over 500-feet long was required.

At the ends of the bridge is a large amount of loose rock of a character which is unsuitable as foundation material for the ordinary type of bridge. To construct a supporting pier for the ends of the structure would have been uneconomical and unsafe, since preliminary investigation indicated that the material would undoubtedly slide. To overcome this difficulty the end spans are tied back to the middle portion of the bridge which rests on three large piers so constructed in the solid material as to provide permanent firm anchorage.

TWO CENTRAL SPANS

The structure consists of two central spans open spandrel arches each 177-feet, 6-inches in length. At either end of these arches there is an 81-foot, 6-inch cantilever, or tied-back arch, and a 34-foot, 6-inch concrete girder span. The bridge will provide a 24-foot roadway between curbs.

In general appearance, the structure will be somewhat similar to the other concrete arches between Carmel and Big Creek, such as the structures at Rock Creek and Garrapadis Creek. The end spans of the arch, instead of resting on abutments, are supported by steel eye-bars which extend the full length of the arch span and are located in the outside girders. The stress in the eye bars is transmitted from the cantilever arches—or the end span arches—by means of structural steel brackets around which the concrete is poured in the arch rib.

The steel ties are prestressed for full dead load by means of toggle joints and 125-ton hydraulic jacks which are placed at the center pier. When there is no live load, such as highway traffic, on the bridge, the end spans are tied through the bridge to each other and balance themselves.

(Continued on page 28)

Atascadero-Morro Bay Highway

(Continued from page 19)

Completion and opening of the project makes available another scenic and service road for San Luis Obispo and the San Joaquin Valley counties.

PROGRAM OF SPEECHES

Following the dedication ceremonies, a luncheon was served to State and county officials and interested citizens of San Luis Obispo County at the Morro Beach Inn at Morro Bay. After the luncheon, at which Dr. Ward presided, addresses were made by H. R. Judah, Chairman of the California Highway Commission, and by Edward J. Neron, Deputy Director of Public Works, representing Governor Merriam for the occasion. Brief talks were made by Claude Arnold, Chairman of the San Luis Obispo County Supervisors, A. L. Ferrini, County Supervisor, Superior Judge T. A. Norton, Phillip A. Stanton and Paul G. Jasper of the California State Highway Commission, Mayor Newell of Ventura, State Senator Chris Jespersen and by various citizens of San Luis Obispo County.

Congratulations were exchanged between the visiting State officials and county residents on the cooperative efforts culminating in the completion of a highly desirable addition to the State Highway System.

NEW BOOK ON DAMS ISSUED

Dams, control works and special engineering investigations of the Bureau of Reclamation are described in detail in a new book entitled "Dams and Control Works" published by the Department of the Interior.

Chapters are devoted to the design, and the construction of such outstanding structures as Boulder, Grand Coulee, and Imperial dams, and special articles written by experts of the Bureau of Reclamation staff are devoted to "High Pressure Reservoir Outlets," in the design and improvement of which the Bureau has had a large part, "Temperature Control of Mass Concrete in Large Dams," and other similar topics.

Of particular interest to engineers and students, the various descriptions and discussions are illustrated by photographs and engineering drawings.

"You seem very happy."

"I am. I'm secretly engaged and everybody's talking about it!"

Flood Damage in Modoc County Prevented by State Engineers

(Continued from page 23)

had the closest equipment and manpower and it was thought they could prevent the levee from being overtopped until heavy dirt moving equipment could be transported to this remote place. The men from the camp scouted a possible path for a caterpillar and moved the camp bulldozer about half way into the levee on May 10th. A second bulldozer equipped with lights, which was dispatched from Likely on its own power, passed the camp bulldozer during the night. After fifteen hours of continuous struggle over almost insurmountable difficulties (the "Cats" being mired to their ears on numerous occasions) both arrived at the dam and commenced raising the freeboard.

The closest truck transport for moving an RD8 and 12 yard carry-all was located at Susanville. Harms Brothers made this equipment available and two RD8 and 12 yard carry-alls were moved to the job in the following two days. This equipment walked in from Likely to the levee in 7 hours due to the rapidly improving bulldozer trail with favorable weather conditions prevailing.

NARROW ESCAPES

The assistance of the Division of Highways was enlisted to improve an old wagon road leading from Madeline to the tunnel portal at the west end of Tule Lake Reservoir. This made it possible for camp equipment and supplies to be delivered by truck at the tunnel portal and transported by motor boats six miles across the reservoir to the Cedar Creek levee. A strong wind, which prevailed for the duration of the work, caused the boat trip to be somewhat hazardous. One boat capsized with two operators and a load of equipment and supplies. The operators, who were equipped with life preservers, swam safely ashore. Most of the load was lost in the reservoir but the boat, which was equipped with two outboard motors, was saved.

The work of raising and widening the Cedar Creek levee was completed and the emergency was over on May 19th. The levee was raised an additional height of 6½ feet and was widened 30 feet by bulldozing a berm in the water across the front face. The length of the levee was increased from 600 to 1050 feet. The total additional earth placed in the levee was 15,000 cubic yards. Working conditions were extremely adverse for efficient operation, the average haul being about 1400 feet. Good material would be readily available during the dry-weather season if the reservoir was partially emptied.

The water level in Tule Lake Reservoir continued to raise until June 6th at which time it was higher than the top of more than 400 feet of the old levee. All seepage through the levee was cut off by the berm thrown across the front face. The dam is considered safe for the summer season, but certain additional work will be required to be done by the owner before fall to permanently eliminate any hazard from this source.

PORTERVILLE OPENS NEW HIGHWAY

(Continued from page 9)

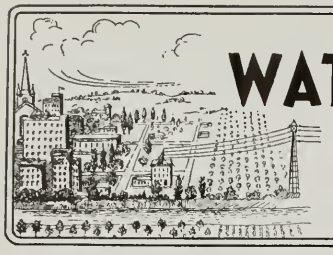
Mayor Charles Cummings opened the dedicatory ceremonies and introduced James Fauver, chairman of the Tulare County Water Commission, as master of ceremonies. Rev. J. A. Milligan delivered an invocation. Brief addresses were delivered by Director Kelly, Mr. Hopkins, Commissioner Hart, Commissioner Judah and Supervisor Woollomes.

Two charming Porterville girls, Miss Betty Jones and Miss Joan Berry assisted Director Kelly in cutting the ribbon stretched across the new roadway.

SAFETY CONFERENCE TO MEET

The Western Safety Conference, comprising officials and groups interested in the cause of traffic, home, industrial, and public safety generally, will be held in Los Angeles at the Ambassador Hotel, September 12-16, inclusive.

It is announced that the conference will cooperate in creating a safety program that will greatly aid in reducing accidents and the death toll on highways, in the home and in industry generally.



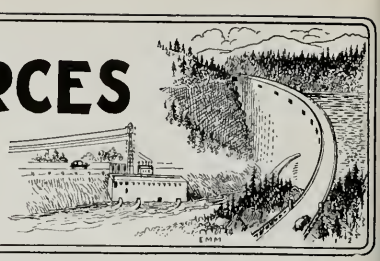
DIVISION OF WATER RESOURCES

OFFICIAL REPORT

FOR THE MONTH OF

June, 1938

EDWARD HYATT, State Engineer



THE Division of Water Resources representing the Department of Public Works has continued investigations of applications for allotments from money appropriated to the Emergency Fund by Chapter 11, Statutes of 1938, Extra Session, for the restoration of public property, levees, flood control works, county roads and bridges, damaged by recent floods throughout the State, pursuant to instructions from the Director of Finance. About 200 applications, applying for more than $20,000,000 have been received. Investigations of most of these applications have been made and reports on many of them have been prepared and others are now in preparation. Reports and recommendations on these applications are being made by this Division and the State Reclamation Board to the Director of Finance and eighty-three of such reports have been issued. Allocations totaling $1,901,200 have been approved by Governor Merriam and allotments totaling $1,563,100 have already been made for the flood damage repair work pursuant to the reports of the Division and the State Reclamation Board.

IRRIGATION DISTRICTS

A petition for the formation of Delano-Earlimart Irrigation District was presented to the Board of Supervisors of Tulare County and a copy filed in this office June 15, 1938. The proposed new district embraces an area of some 30,000 acres located 25 miles north of Bakersfield on the line of the Friant Kern Canal of the Central Valley Project.

A proposal to organize a water conservation district on San Luis Rey River for the purpose of constructing storage at the Bonsall reservoir site is being sponsored by Fallbrook and Vista irrigation districts in cooperation with the cities of Oceanside and Carlsbad in San Diego County.

Projects under way in the Lindsay-Strathmore Irrigation District include extensive replacement of existing distribution pipe lines which have been in service for more than twenty years. Requests for approval of expenditures of $10,000 for this purpose and of $4,000 for purchase of additional land was reported upon to the Securities Commission during the month.

Appointment of a new director in Buena Vista Water Storage District in Kern County was made on June 7, 1938, to fill a vacancy on the Board caused by resignation of one of the members.

SUPERVISION OF DAMS

Applications for the repair of Littlerock Dam, Pacoima Dam, San Dimas Dam have been received and approved. The application for repair of the Fairmount Dam in the City of Riverside was approved and construction work has started.

The application for the construction of the Suttenfield Dam at the Sonoma State Home was received and approved and the application for the construction of the Charles Lee Tilden Park Dam has been revised and resubmitted for approval.

SACRAMENTO-SAN JOAQUIN WATER SUPERVISION

The field work of this office is now going forward on the regular summer schedule and all points of diversion are being visited and measurements of the diversions made.

Substantial progress is being made in compiling the annual mimeograph report and it should be completed during the coming month. This will show the amount of water diverted from and returned to streams in the Sacramento-San Joaquin territory. It will also show the amount of land irrigated, flow in the stream channels and the rate of advance and retreat of salinity in the delta.

The stream flow into the delta from the Sacramento Valley has shown a marked decrease but the flow from the San Joaquin continues at a high rate. The flow of the Sacramento River on June 24th was about 28,000 cubic feet per second. On the same day the flow of the San Joaquin at Lathrop was 18,000 cubic feet per second. On the corresponding date last year, the flows were 12,400 and 12,500, respectively.

TOPOGRAPHIC MAPPING

Final maps of the Gorman, Liebre, Quail, and Bear Trap quadrangles covering areas in northwestern Los Angeles County are now available. These are published on a scale of 1:24,000 with contour intervals of 5 feet and 25 feet. The work was done by the Geological Survey in cooperation with Los Angeles County.

Plan and profile drawings of Sacramento River from Red Bluff to Mile 65 and Clear Creek from the confluence to French Bluff are now available. These are published in 6 sheets with a horizontal scale of 1:31,680 and the vertical scale is one inch equals 20 feet.

Advance sheets of Sebastopol quadrangle in Sonoma and Marin counties are now available. These are published on a scale of 1:48,000 with 25 feet contours. The last named is a cooperative sheet.

WATER RIGHTS

Nineteen applications to appropriate water were filed last month. Ten were denied, thirteen were approved and the rights under three applications were confirmed by the issuance of license.

CALIFORNIA COOPERATIVE SNOW SURVEYS

With the opening up of the mountain roads during the past month, the snow surveying equipment that had been kept in the shelter houses during the winter was gathered and collected at convenient central locations. It is now being repaired and put in good shape and will be stored away for distribution to the shelter cabins again next fall.

Work in the office has continued; forecasts previously made have been given a final check and forecasts not regularly published have all been predicted from the data gathered during the winter. Snow-pack runoff curves are being revised and brought forward and supporting data gathered during the last autumn and winter are being reviewed and put into shape for permanent filing.

CENTRAL VALLEY PROJECT

Work was continued by the Division of Water Resources, representing the Water Project Authority of the State of California, on engineering studies in connection with the Central Valley Project which are being carried on under a cooperative work agreement with the U. S. Bureau of Reclamation. These studies have comprised the obtaining of data to be used in connection with negotiations for the acquisition of water rights.

Highway Bids and Awards for the Month of June, 1938

BUTTE COUNTY—Between 6 miles south and 1 mile south of Paradise, about 4.6 miles in length, a graded roadbed to be constructed. District III Feeder roads. Fredericksen & Westbrook, Lower Lake, $43,570; Claude C. Wood, Stockton, $44,610; M. J. Ruddy, Modesto, $45,771; George K. Thompson & Co., Los Angeles, $49,061; Hemstreet & Bell, Marysville, $50,865; Johnston Rock Co., Inc., Stockton, $62,635; Ralph A. Bell, Monrovia, $79,955. Contract awarded to Chas. L. Harney, San Francisco, $38,330.

CALAVERAS COUNTY—Between 2.5 miles East of Valley Springs and San Andreas, about 5.9 miles in length to be surfaced with gravel and plant-mixed surfacing. District X, Route 24, Section B. Claude C. Wood, Stockton, $57,386; Lee J. Immel, Berkeley, $63,398; Pacific States Const. Co., San Francisco, $63,489; Hanrahan Co, Redwood City, $63,688; Union Paving Co., San Francisco, $69,250; Independent Construction Co. Ltd., Oakland, $71,622; Mountain Const. Co., Sacramento, $73,906. Contract awarded to Piazza & Huntley, San Jose, $54,071.90.

CALAVERAS COUNTY—Two concrete bridges, one across Haupt Creek and the other across North Fork of Calaveras River, at point about 4.0 and 7.5 miles East of Valley Springs. District X, Route 24, Section B. Valley Constr. Co., San Jose, $43,621; Campbell Construction Co., Sacramento, $49,296; Williams Bros., & Haas Inc., San Francisco, $52,056; Chas. L. Harney, San Francisco, $52,344; Mountain Const. Co., Sacramento, $52,488; S. A. Cummings, San Diego, $52,890; B. A. Howkins & Co., San Francisco, $58,274; A. Soda & Son, Oakland, $58,352; J. S. Metzger & Son, Los Angeles, $59,791; Palo Alto Road Materials Co., Palo Alto, $59,818. Contract awarded to F. Kaus, Stockton, $41,679.50.

LOS ANGELES COUNTY—Construction of sewers, manholes, junction chambers and flush tank in South Pasadena between Arroyo Drive and Meridian Avenue. District VII, Route 205, Section South Pasadena. E. L. Flemming &B. O. Zaich, Los Angeles, $7,562; Artuckovich Bros., Hynes, $7,689; Gogo & Rados, Los Angeles, $8,369; Sutalo & Ramljik, Los Angeles, $7,112; Peter S. Tomich, Los Angeles, $8,365; Culjak & Zelko, Los Angeles, $7,253; Radich & Brown, Los Angeles, $7,338; J. E. Haddock, Ltd., Pasadena, $7,330; M. F. Kemper, Los Angeles, $6,049; P. & J. Artukovich, Los Angeles, $6,548; R. A. Wattson, Los Angeles, $8,274; Jack T. Cantella, Los Angeles, $8,125; Griffith Co., Los Angeles, $7,329; J. L. Kruly, Los Angeles, $8,379; Bebek & Brkich, Los Angeles, $7,189. Contract awarded to V. C. K. Const. Co., Los Angeles, $6,015.05.

MERCED COUNTY—Between 5.7 miles southerly and Merced, about 5.7 miles in length to be graded, portions to be paved with P. C. C. and A. C. Portions to be surfaced with plant-mixed surfacing on untreated crushed gravel or stone and reinforced concrete bridges to be constructed. District X, Route 4, Section A. Union Paving Co., San Francisco, $372,508; Griffith Co., Los Angeles, $358,414; Macco Const. Co., Clearwater, $337,328; United Conc. Pipe Corp., Los Angeles, $384,606; Fredericksen & Westbrook, Lower Lake, $358,636; Warren Southwest, Inc., Los Angeles, $369,535; Chas. L. Harney, San Francisco, $396,888. Contract awarded to Hanrahan Co., San Francisco, $335,324.20.

MERCED COUNTY—Reinforced concrete bridge to be constructed across North Branch Mud Slough about 5.2 miles East of Gustine. District X, Route 122, Section A. J. S. Metzger & Son., Los Angeles, $13,813; Palo Alto Road Materials Co., Palo Alto, $13,208; Franzini & Fredenburg, San Rafael, $12,069; F. Kaus, Stockton, $14,438. Contract awarded to M. A. Jenkins, Sacramento, $11,982.

MONTEREY COUNTY—Salinas River Bridge approaches at Soledad, about 1.0 mile in length to be graded and paved with Portland cement concrete. District V, Route 2, Section D. N. M. Ball Sons, Berkeley, $52,755; Fredericksen & Westbrook, Lower Lake, $57,015; Louis Biasotti & Son, Stockton, $58,414. Contract awarded to Granite Constr. Co., Ltd., Watsonville, $44,566.

ORANGE COUNTY—Near Galivan, about 1.2 miles in length to be graded and surfaced with plant-mixed surfacing. District VII, Route 2, Section A,B. Ralph A. Bell, Monrovia, $69,204; Daley Corp., San Diego, $56,316; A. S. Vinnell Co., Alhambra, $65,736; Sully Miller Contr. Co., Long Beach, $67,961; Martin Bros. Trucking Co., Long Beach, $62,521; Winston Bros. Co., Los Angeles, $74,142; Gibbons & Reed Co., Burbank, $72,496; Claude Fisher Co., Los Angeles, $64,271; Macco Const. Co., Clearwater, $56,101; Basich Bros., Torrance, $56,540; C. R. Butterfield-Kennedy Co., San Pedro, $57,900; S. Edmondson & Sons, Los Angeles, $67,408; George J. Bock Co., Los Angeles, $64,572; C. O. Sparks & Mundo Eng. Co., Los Angeles, $65,638; Dimmitt & Taylor, Los Angeles, $59,393; Radich & Brown, Los Angeles, $72,063; Triangle Rock & Gravel Co., San Bernardino, $71,403; Oswald Bros., Los Angeles, $56,812; Griffith Co., Los Angeles, $61,731; J. A. Haddock Ltd., Pasadena, $57,612; Clyde W. Wood, Los Angeles, $65,281; United Conc. Pipe Corp., Los Angeles, $58,882. Contract awarded to V. R. Dennis Const. Co., San Diego, $52,996.50.

PLUMAS COUNTY—Between southerly boundary and Vinton, about 7.4 miles in length to be graded and penetration oil treatment applied. District II, Feeder Roads. Fredericksen & Westbrook, Lower Lake, $43,566; Embleton-Schumacher Co., Albany, $44,199; Isbell Const. Co., Reno, Nev., $44,700; Claude C. Wood, Stockton, $45,217; M. J. Ruddy, Modesto, $47,534; Clifford A. Dunn, Klamath Falls, Ore., $47,876; Geo. Pollock Co., Sacramento, $49,436; Mountain Const. Co., Sacramento, $52,366; Chas. L. Harney, San Francisco, $53,156; Union Paving Co., San Francisco, $55,739; Geo. K. Thompson & Co., Los Angeles, $60,023. Contract awarded to Harms Bros., Susanville, $43,077.40.

PLUMAS COUNTY—Bridges at Rock Creek, Chipps Creek and Yellow Creek and a culvert at Little Indian Creek to be constructed and about 0.25 mile of roadway to be graded. District II, Route 21, Sec. A. A. Soda and Son, Oakland, $71,584. Contract awarded to Campbell Construction Co., Sacramento, $63,891.

SANTA BARBARA COUNTY—Between Los Olivos and Zaca about 3.0 miles in length to be graded and surfaced with imported borrow and road-mix surface treatment applied. District V, Route 80, Section A. J. E. Haddock, Ltd., & Crow Bros., Const. Co., Pasadena, $65,575; N. M. Ball Sons, Berkeley, $67,592; M. J. Ruddy, Modesto, $62,934; A. S. Vinnell Co., Alhambra, $65,692; Basich Bros., Torrance, $67,078; George K. Thompson & Co., Los Angeles, $68,795; Oswald Bros., Los Angeles, $69,116; Gibbons & Reed Co., Burbank, $69,980; Guerin Bros., San Francisco, $71,613; C. R. Butterfield-Kennedy Co., San Pedro, $73,856; United Concrete Pipe Corp., Los Angeles, $74,636; Dimmitt & Taylor, Los Angeles, $80,899; C. O. Sparks & Mundo Eng. Co., Los Angeles, $90,176. Contract awarded to Macco Const. Co., Clearwater, $61,264.55.

SAN LUIS OBISPO COUNTY—Between Summit and 3 miles south of Paso Robles, 2 timber bridges and a corrugated multiplate culvert, to be constructed and about 0.3 mile of roadway to be graded and road-mix surface treatment applied. District V, Route 33, Section E. Robert B. McNair, Oakland, $24,239; Franzini & Fredenberg, San Rafael, $26,020; Granite Construction Co., Ltd., Watsonville, $26,594; S. A. Cummings, San Diego, $27,706; L. A. Brisco, Arroyo Grande, $27,914; Rexroth & Rexroth, Bakersfield, $28,784; R. R. Bishop, Long Beach, $29,040; Albert H. Siemer & John Carcano, San Anselmo, $31,332. Contract awarded to E. G. Perham, Los Angeles, $21,616.20.

SHASTA COUNTY—At 0.8 mile east of Bella Vista and between Seamen's Gulch and 6.3 miles east of Ingot, about 7.7 miles in length, to be graded and surfaced with crusher run base and salvaged surfacing base, and R. C. Box Culvert to be constructed. District II, Route 28, Section A.B. Clifford A. Dunn, Klamath Falls, Ore., $89,700; Pacific States Construction Co., San Francisco, $94,866; N. M. Ball Sons, Berkeley, $99,442; Mountain Const. Co., Sacramento, $117,185. Contract awarded to C. W. Caletti & Co., San Rafael, $86,095.45.

TRINITY COUNTY—At various locations between Big Bar and Junction City about 4.1 miles in length to be graded and surfaced with road mix surfacing and penetration oil treatment. District II, Route 20, Sections E.F. Harold Smith, St. Helena, $89,224; N. M. Ball Sons, Berkeley, $106,280. Contract awarded to Young & Son Co., Ltd., Berkeley, $87,874.60.

TRINITY COUNTY—Between 1 mile southwest of Hayfork and ½ mile east of Duncan Creek, about 2.2 miles in length, to be graded, imported surfacing material placed and penetration oil treatment applied. District II, Route 35, Section B. Young & Son Co., Ltd., Berkeley, $19,805; Helwig Const. Co., Sebastopol, $21,773; N. M. Ball Sons, Berkeley, $22,393; Harold Smith, St. Helena, $22,763; Lee J. Immel, Berkeley, $24,648; Piazza & Huntley, San Jose, $22,807; Geo. Pollock Co., Sacramento, $24,902; A. Soda & Son, Oakland, $33,613. Contract awarded to Harms Bros., Susanville, $19,739.

YUBA COUNTY—At Dry Creek about 13 miles east of Marysville, a reinforced concrete bridge to be constructed and about 0.2 mile of roadbed to be graded and seal coat applied. District III, Route 15, Section A, B. Hemstreet & Bell, Marysville, $50,681; Campbell Construction Co., Sacramento, $53,606; C. W. Caletti Co., San Rafael, $55,081; Holdener Construction Co., Sacramento, $56,273; J. S. Metzger & Son., Los Angeles. $56,850; J. M. Walker, Berkeley, $61,959. Contract awarded to Valley Construction Company, San Jose, $49,734.

A business genius is a man who knows the difference between being let in on a deal and taken in on one.



This is another view of the Big Creek Bridge being constructed on Carmel-San Simeon Highway

Big Creek Bridge is Unique

(Continued from page 24)

When there is an unbalanced live load, such as a heavy truck on one end of the bridge, this unbalanced load is supported by transmitting the stresses through the eye bars to the main piers, which are designed to take care of such unbalanced live load.

SPAN WILL REVOLVE

From the ends of the cantilever spans are two short girder spans 34-feet, 6-inches long, which rest on the ground and are fastened to the main structure by hinges. This arrangement is provided so that if the ground should move the span will revolve about the hinge, and there will be no ill effect on the main structure.

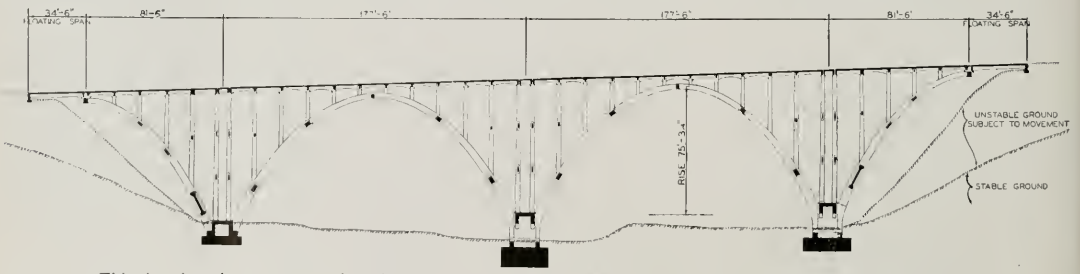
The concrete in the arch ribs was supported on timber falsework built according to accepted practice. However, instead of using a highline for erecting falsework and transporting materials, the contractor utilized the falsework to support a runway for workmen and concrete buggies at the elevation of the roadway.

During the heavy storm last winter, the wind, which reached a velocity of over 70 miles per hour, blew down the timber falsework, of which about 80 per cent was in place. This accident delayed the time of completion.

SMOOTH CONCRETE SURFACES

For the forms the contractor elected to use plywood. All the rib and column forms were laid out accurately on the ground and later erected in place. The use of plywood accompanied by this careful procedure will result in smooth concrete surfaces and lines. To keep construction joints to a minimum, the arch columns were poured the full length in one operation in order to obtain a smooth concrete surface without unsightly joints. Because of the proximity to the ocean, and the deteriorating effect of salt water and air, great care was taken in designing the concrete mix to secure as dense and strong a concrete as possible.

The Big Creek Bridge, costing approximately $146,000, will be completed about September 1st. C. O. Sparks and Mundo Engineering Company are the contractors.



This drawing shows construction plan of unusual Big Creek Bridge now being built by Division of Highways

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MAP OF

CALIFORNIA

SHOWING

UNITED STATES AND STATE NUMBERED HIGHWAYS

Statute Miles

LEGEND

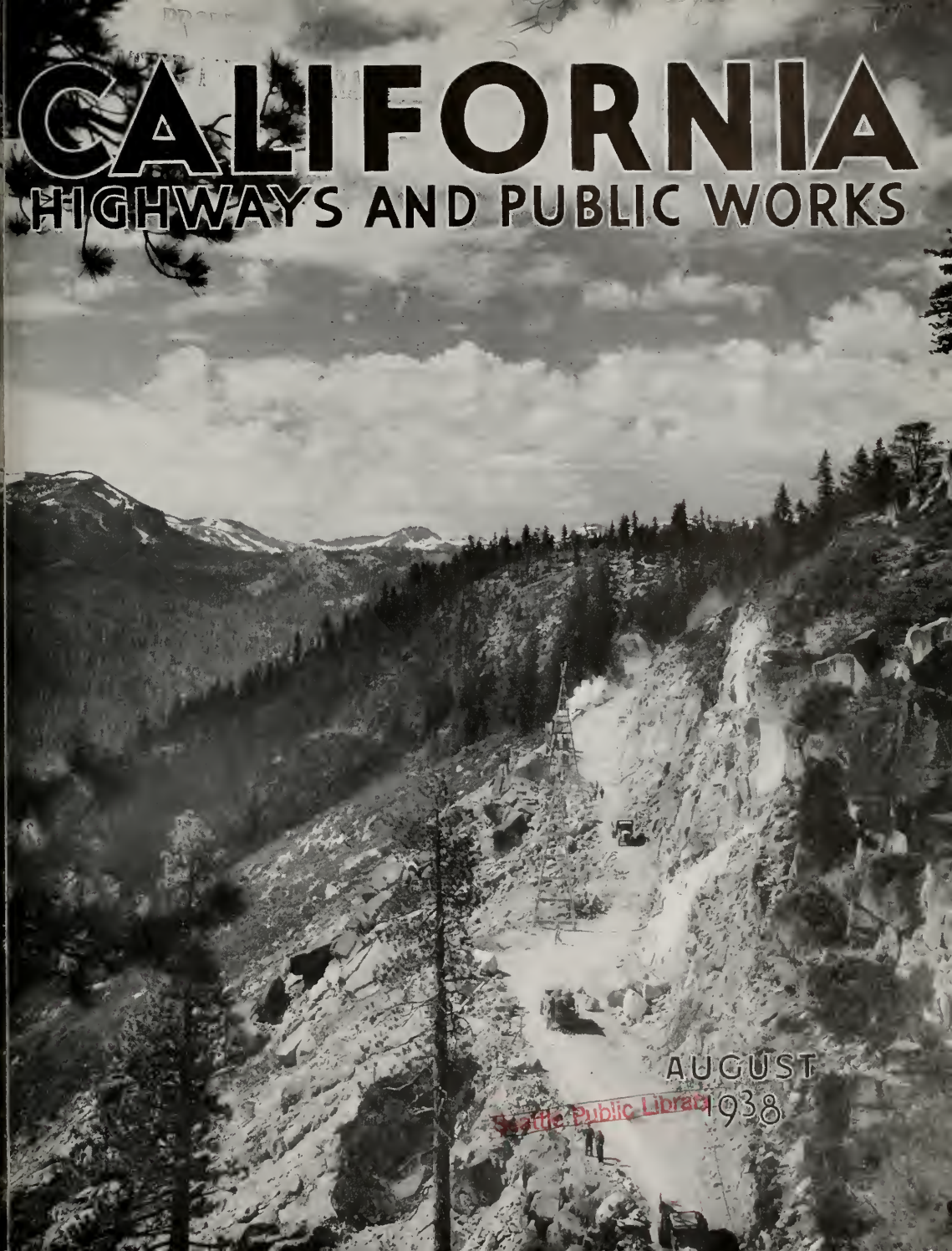
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- UNITED STATES HIGHWAYS - NOT SIGNED
- STATE HIGHWAYS - SIGNED
- STATE HIGHWAYS - NOT SIGNED
- COUNTY ROADS - SIGNED
- STATE HIGHWAYS - NOT CONSTRUCTED

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CALIFORNIA HIGHWAYS AND PUBLIC WORKS

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EARL LEE KELLY, Director C. H. PURCELL, State Highway Engineer JOHN W. HOWE, Editor K. C. ADAMS, Associate Editor

Published for information of the members of the department and the citizens of California

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Vol. 16 AUGUST, 1938 No. 8

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Construction Work Held Up

Funds Lacking for Requirements of 1300 Miles of State Highways and 377 Bridges in District III

By Charles H. Whitmore
District Engineer, District III

THE rapid increase in the number and weight of motor vehicles; the recent doubling of the mileage in the State Highway System; the raising of standards of new State highway construction to provide additional safety at increased speed; the public demand for improved service, such as, expansion of snow removal service, traffic stripes, weed control, roadside planting, etc.; and the decrease in funds available for use on State highways because of the allocation of a portion of the funds to the cities for use on city streets have created a serious problem which is now confronting this department.

The effect of the decrease in finances for construction purposes in relation to the needs is made evident by many miles of highways and numerous bridges which are inadequate to serve traffic requirements properly.

To present a picture of the State's highway problem as it exists today, the District Engineers in each district in the highway system have been asked to report on the conditions and needs in their respective districts.

The following is a report by District Engineer Charles H. Whitmore of the situation as it exists in District III:

District III comprises the area occupied by eleven counties located in the southerly portion of the Sacramento River Valley and the mountainous section between the valley and the Nevada state line; namely, the counties of Butte, Colusa, El Dorado, Nevada, Placer, Glenn, Sacramento, Sierra, Sutter, Yolo, and Yuba.

The mileage of State highways in the district is approximately 1375 miles, of which 58 miles are within the limits of incorporated cities. This mileage is approximately 10 per cent of the total in the State Highway System.

The topography of District III is such that we have valley, foothill, and mountain roads. Climatic conditions vary from extreme heat in the valley to extreme cold and snow in the mountain areas.

The status of improvement of the roads in the district, exclusive of bridge decks and city streets, is:

26 miles,	or 2%,	unimproved and unoiled earth roads.
13 miles,	or 1%,	unimproved and unoiled gravel roads.
130 miles,	or 10%,	oiled earth roads inferior as to grade, alignment, and width.
195 miles,	or 15%,	graveled roads with oiled surface.
520 miles,	or 40%,	intermediate type of surface.
416 miles,	or 32%,	high type pavement.

There are 377 bridges in the district with a total length of 50,700 lineal feet, or 9.6 miles. Nine of these bridges are of movable span type over the Sacramento River and seven of them require operators on duty at all times. The operation and maintenance cost of the movable span type is approximately $4,000 a year for each of the seven operated bridges, or $28,000 a year.

There are 142 railroad grade crossings and 45 grade separation structures in the district. Many of the grade crossings on important routes are extremely hazardous and should be eliminated. Little progress has been made in eliminating grade crossings in this district in the last few years. Only one Federal grade separation project has been allotted to this district, construction on which is expected to start soon.





Obsolete one-way suspension bridge on the Mother Lode highway in Placer County. (Below) "Road of a Thousand Curves" on Nevada City-Downieville Route in Nevada County.







Top—Steep approach on curve to railroad grade crossing on Placer County road. Center—Narrow bridge on sharp curve alignment creates hazardous driving conditions on this Nevada County highway. Bottom—Narrow bridge between Marysville and Yuba City with restricted speed for loads over 10 tons occasions many traffic jams.

We have six State highway routes crossing the Sacramento River and adjacent low lands. Five of these routes contain sections which are submerged during flood periods most every winter, and traffic is stopped entirely or is required to pass, subject to traffic control, through water for distances varying from a few hundred feet to a mile or more.

The route entering Sacramento from the north is subject to overflow at the American River, and flood gates are operated to prevent water from flooding North Sacramento. When these gates are closed it is necessary to detour all traffic over unsatisfactory roads. The route leading from Sacramento to Amador County is subject to overflow at the Cosumnes River.

Snow removal is required during normal years on 415 miles or 30 per cent of the highways in the district. The average yearly cost of this work is about $110,000, or approximately $220 a mile. During the past winter we had a total snowfall at Donner Summit of approximately 600 inches, or 50 feet. Our cost of snow removal was approximately $170,000, or $400 a mile.

By adding the average cost of snow removal and maintenance and operation of movable span bridges we find that we have a yearly maintenance cost of approximately $138,000, or $110 a mile for all roads in the district which we are obligated to expend for service, none of which may be considered as expenditure for the maintenance of the surface or roadside of the 1300 miles of roads in the district. Most of the other districts do not have as many movable span bridges or as extensive snow removal operations, and a greater proportion of the funds allotted to them may be expended for repair of roads, surfacing, and roadside improvement than is possible in District III.

All the earth, gravel, and oiled earth and gravel roads are inferior as to grade, alignment, and width.

Top—This narrow, obsolete type subway with a sharp curve approach is a driving hazard near Roseville on U. S. 99-E. Center—A narrow bridge with short sight distance makes careful driving necessary on this section of U. S. 99-W in Yolo County. Bottom—Blind vertical curve to narrow bridge on Placer County highway.







They should be improved with construction funds in order to serve traffic properly.

Of the intermediate type roads 90 per cent needs new construction or reconstruction in order to provide satisfactory alignment, grade, and roadway width for existing traffic.

Our report of status shows 416 miles, or 32 per cent, of the roads in the district as high type pavement. The recording of that fact without explaining would be misleading. There are approximately 400 miles of highway in the district which has been surfaced with Portland cement concrete or asphaltic concrete; however, approximately 280 miles, or 70 per cent, of the 400 miles listed is old pavement only 4 and 5 inches in thickness, 12 and 15 feet wide, on poor alignment, blind vertical curves and excessive grades, and was constructed from 15 to 20 years ago. The old pavements have been made usable by widening with intermediate type surfacing to a 20-foot width and placing thin bituminous retreads or blankets on the surface. Heavy loads, high speed, and pavement deterioration have brought many miles to a state of near collapse.

Bridge construction in the district is not keeping up with requirements. Based upon bridge deck areas 66 per cent of the bridges are obsolete and entirely inadequate to serve traffic demands properly. Narrow bridges with restricted sight distances are prevalent on main routes of travel.

It is estimated that to put the roads and bridges in the district in condition to serve present traffic condition would require:

537 miles new construction	$21,800,000
590 miles reconstruction	14,700,000
50,700 lin. ft. bridges	7,500,000
Total required	$44,000,000

A review of the district's expenditures for the past nine years shows construction expenditures varying from a low of $539,300 to a high of

(Continued on page 20)



Partially completed highway relocation on east side of Echo Summit. Meyers in center right and Lake Tahoe in distance.

Realigning Tahoe Highway Grade

IN THE Sierra mountain region of El Dorado County there is under construction a grading contract of a short but important unit on U. S. Route 50. It is a relocation of the road over Echo Summit and includes the upper part of Meyers Grade, on the Placerville-Lake Tahoe Highway.

The revised highway departs from the existing road two miles east of Phillips Station, trending southeasterly on easy grade through timbered land to a small pass in the ridge east of the existing highway summit, at a site where the old Hawley Grade wagon road passed. This road was built in 1858 to provide a shorter route to the gold country and was used till 1861.

From the Hawley Grade crossing the current construction descends on not to exceed 5.6 per cent grade to a point on the present Meyers Grade below the switchbacks. It will eliminate the present switchbacks, poor curvature, and the steep grades of 11 per cent and over on the superseded stretch. Eventually the relocation will be extended to modernize the entire length of Meyers Grade to the lake valley.

The construction of this 2.3 mile unit is undertaken as a National Forest Highway Project, financed from Forest Highway Funds. The location was established by surveys of the State Division of Highways with final plans completed by the U. S. Bureau of Public Roads, under whose jurisdiction the contract is conducted. The construction will approximate an expenditure of $303,000.

West of the summit no difficult construction is involved in obtaining excellent roadway standards. From the summit to the easterly end of the contract, one mile, the work passes through irregular rock bluffs that top the steep slopes high above the valley floor. On this mile the design and construction of a roadway for a 24-foot crown width of surface present a difficult problem. Solid benching, retaining walls and concrete bridging were the practical means of providing roadway. At only several places would fills hold and in these places but to limit extent.

The desire to keep construction scars to the minimum on this recreational route influenced design and affected construction methods. Cabins and lodges along the brink of the crest above the highway location increased difficulties. Careful attention is being given to landscaping. The contractors are Louis Biasotti & Son and John Rocca.

Although completion of the contract is not expected until the fall of 1938, the present status of the job shows excellent results. As construction operations proceeded, the excavation lines in the high cutting of the fractured rock formation east of the summit have in general held unusually close to neat cross-section, avoiding excessive overbreak and resultant waste scars.

Careful engineering and construction work are evidenced. Cement rubble masonry walls maintain support for much of the roadway in critical stretches, with design of these

(Continued on page 6)



On sheer eastern cliffs of Echo Summit power shovel is making final cut for Meyers grade relocation. Lake Tahoe in distance.



View of new construction on Echo Summit looking south toward Luther Pass. Arrows indicate portions of old Hawley Grade.

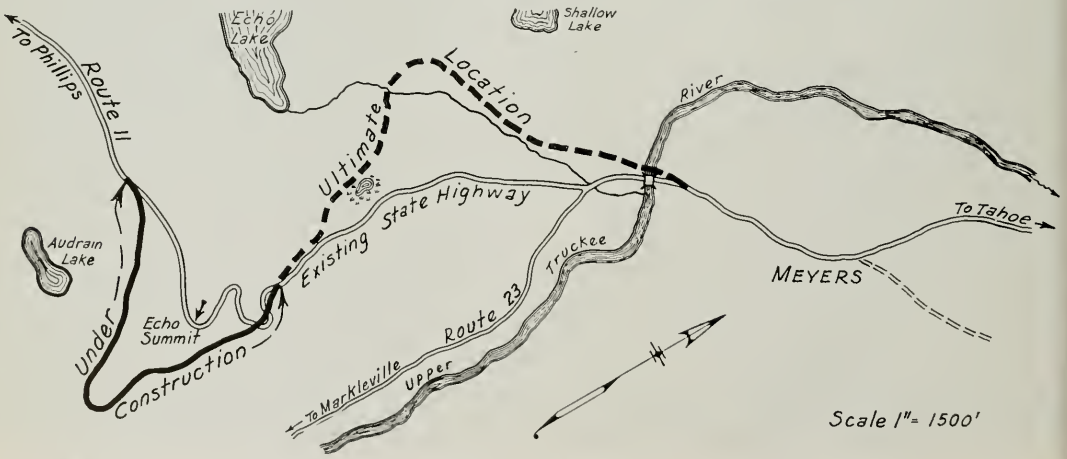
features well in keeping with the character of the country traversed.

The new construction will be a spectacular section of the Tahoe Highway. Coming from the west the motorist will pass from an avenue of virgin timber to a vista overlooking the panorama of the Lake Tahoe basin. The transition will be made over a sweeping summit curve, widened and safeguarded.

The descent that follows will be on a roadway where width, curvature, grade and sense of security will be in marked contrast to the present road. The new road will facilitate maintenance, especially in providing reasonably safe conditions when snow removal is required to keep the route open. Similar road standards will apply when the entire grade can be reconstructed to Meyers.

Surface treatment is not included in the current contract. Provision for this item will be made by the State.

The U. S. Bureau of Roads officials in charge of the project are: L. I. Hewes, Deputy Chief Engineer; C. H. Sweetser, District Engineer; Levant Brown, Senior Highway Engineer, in charge of Forest and Park roads construction; E. C. Brown, Senior Highway Engineer, as Supervising Engineer, and M. M. Flint, Resident Engineer.



Map shows how relocated route will eliminate switchbacks below Echo Summit on existing Meyers Grade of Tahoe Highway.

Highway Commission Head Urges Necessity of Protecting Gas Tax

By H. R. JUDAH, Chairman, California Highway Commission

CALIFORNIANS generally are zealous of the value and importance of gasoline tax revenues. They know now from years of experience in the paying of the four cents per gallon excise at the pump, that there has been created for their enjoyment and profit out of these revenues one of the finest systems of highways the world has ever seen, with its completion and perfection still a long way off.

There is no question but what the gasoline tax in this State is the most popular form of taxation yet devised and for a use that is equally popular—the building of primary and secondary highways and bridges and the reconstruction and maintenance of the State system in all of its component parts.

For the purpose of safeguarding this splendid system of financing to bring about the ultimate perfection of a well coordinated highway system throughout this great State, the people will go to the polls in November and vote on a proposed constitutional amendment which will provide once and for all that "all moneys collected from any tax now or hereafter imposed by the State upon the manufacture, sale, distribution or use of motor vehicle fuel, for use in motor vehicles upon the public streets and highways over and above the costs of collections, and any refunds authorized by law, shall be used exclusively and directly for highway purposes."

FAVORED BY ADMINISTRATION

This proposed amendment, which has the support of the present State administration from our highway-minded Governor, Frank F. Merriam, down to the lowliest official or worker in the Department of Public Works and the Division of Highways, is presented in such a way that all legal neeessities for its conformation to existing statutes and constitutional provisions, have been provided for.

Under the important provisions of the new amendment is the adherence to the present requirement in the statutes which calls for the expenditure of not more than twenty per cent of one cent per gallon tax on motor vehicle fuel by the legislature for the payment, redemption, discharge, purchase, adjustment, contribution to or refunding of special assessments or bonds or coupons issued for streets or highway purposes and which special assessment districts were initiated by an ordinance or resolution of intention adopted prior to January 1, 1933.

Other provisions of the new constitutional amendment freeze into the State's basic law all of the other well-known stipulations of present day statutes which allow the payment from gasoline tax funds (in the event such use will not in any manner cause the loss of Federal highway funds to the State), of moneys for the discharge and payment of bonds voted at an election prior to January 1, 1935, and issued by a city and county, or county, the proceeds of which have been used exclusively and directly for highway purposes.

STATUTE PROVISIONS PROTECTED

The new amendment provides for temporary loans of gasoline tax income to the State general fund, but specifically requires the return of the money into the original fund for highway purposes. The new amendment also protects section 15 of Article 13 of the State Constitution reading as follows:

"Out of the revenues from State taxes for which provision is made in this article, together with all other State revenues, there shall first be set apart the moneys to be applied by the State to the support of the Public School System and the State University."

It is provided, however, in the matter of loans to the general fund for other purposes, apart from schools, that the moneys so transferred from gasoline tax revenues shall be returned from the first money available in the general fund in excess of those required for the support of the schools and the State University.

PREVENTS ADVERSE LEGISLATION

The extreme importance of a favorable vote by the people in November on the new constitutional amendment may be emphasized by two main reasons. First, unless the use of gasoline tax money for highway purposes is made compulsory by constitutional enactment, the danger of legislative diversion of gasoline tax money to other projects not related to the construction and maintenance of a highway system, will still prevail; and diversion of this money in the future even in the

(Continued on page 25)

4,241,000 Trucks on U. S. Highways

More motor trucks are operating on the highways today than in any period since the beginning of the industry. There are 4,241,000 trucks in the service of farmers, industrial shippers, common and contract carriers, railroads and steamship lines.

Wholesale value of production last year amounted to $545,000,000 or 13 per cent higher than the former record year of 1936.

More than 3,100,000 drivers now are employed in moving commodities over the highways in commercial vehicles. This represents an increase of 5 per cent over the number of persons employed in this capacity during 1936.—*Motor Transportation.*



This accident occurred in day time on paved highway with good sight distance and best driving conditions prevailing in every respect.

Photo Courtesy California Highway Patrolman

Relation of Scientific Engineering

The following article is the first part of a paper on "The Relation of Scientific Engineering to Accident Prevention" prepared and presented by J. W. Vickrey, Safety Engineer of the Division of Highways at the Institute of Government held at the University of Southern California in Los Angeles, June 14, 1938. A second installment will appear in a later issue of this magazine.

By J. W. VICKREY, Safety Engineer, Division of Highways

THE whole subject of Accident Prevention comprises so very many elements, each blending into the other, that no clear-cut lines of demarcation exist. And to add to the confusion, the term "Engineering" is daily being used to cover almost every phase of human endeavor and may also, in fact, be accepted as both an art and a science.

It is, of course, to be understood that the accidents under consideration are motor vehicle traffic accidents. Two quite distinct branches of engineering are most directly concerned, the one dealing with the machine itself and the other with the roadway and its various functions. Whatever we may have to say will be restricted to the latter, and primarily to the rural portion of our highway system.

Gano Dunn defines engineering as "the art of economic application of science to the purposes of man." I make no pretense toward qualifying as a scientist. I do, however, subscribe very definitely to the value of a scientific approach toward the problem of accident prevention. This means the use of known and measurable data in a logical course of reasoning to establish an accurate relationship between cause and effect.

FACTUAL DATA IMPERATIVE

If we are to deal intelligently with accident *prevention*, we must have all the factual data that it is possible to obtain regarding accident *occurrence*—a simple, trite statement, perhaps, and yet one that can not be too strongly emphasized—for it is doubtful if there is any other popularly discussed subject, unless it be economics, about which so much is known that isn't so.

The fundamental relationship which scientific engineering bears toward accident prevention can not be different from that which engineering bears toward any other problem. It differs from pure science in that it is essentially practical and is bound up with economics. A. M. Wellington, well known engineer of the last generation, put it in this way: "To

define engineering rudely, it is the art of doing well with one dollar what any bungler can do with two after a fashion."

The first and foremost need, then, in establishing this relationship of scientific engineering to accident prevention, is for the assembly and analysis of observed facts regarding accident occurrence.

HUMAN ELEMENT UNRELIABLE

The laws of physics are well established and are as a matter of course incorporated in all engineering design. Highways so designed would function perfectly for robot-controlled machines of corresponding design. The laws of human behavior are not so well established, and the machines are driven by you and me and millions of others like us. That we are so alike in a great many of our actions and reactions, provides the basis for hope that highways may be so designed that the chief hazards of accidents will be eliminated.

Individual opinion as to what motorists will do, or even as to what they actually do, is highly unreliable. Factual records so very often show little regard for preconceived notions regarding such things. The need for accurate data being admitted, it follows that both in their assembly and in their later use there must be direction by minds trained to think in terms of scientific engineering—not merely technical experts but those who quite frankly question the truth and value of statements or ideas that can not be, or at least have not yet been, demonstrated.

EXHAUSTIVE ANALYSIS DEMANDED

Accidents do not result from a single cause. This is true not only of the mass but of the individual cases. They each and all result from combinations of circumstance, some comparatively simple and many very complex. Any satisfactory analysis must be so made as to take into account as many as possible of these combinations. Analysis on any other basis is scarcely worth the effort.

Complete and accurate assembly of all pertinent facts, proper marshalling of these facts for review, and exhaustive analysis of recorded combinations: this is the procedure demanded if we are to succesfully cope with the problem of accident prevention.

I have pointed out that engineering is "the *economic* application of science." No matter what freedom may be exercised by other professions, the engineer can not ignore economics.

It is this compelling circumstance that makes necessary an accurate analysis of the whole situation. He must first determine those things that contribute toward those types of accident over which some control is probable or possible through engineering effort. There must then be an arrangement in order of importance as judged by number, severity of consequences, et cetera. Unlimited funds are never available and a choice must be made as to how and where those that are available shall be spent. This is at once the duty and responsibility of the engineer. Final decision may rest with others but this does not relieve him of the obligation to make definite recommendation.

Adequate, satisfactory facilities for the movement of persons and goods by motor vehicle, these are the things

(Continued on page 18)

o Accident Prevention



Too much speed and reckless driving were the attributed causes for a head-on collision of truck and passenger car on a good straight highway.

Photo Courtesy California Highway Patrolman



Recently completed section of route to Pinnacles National Monument in San Benito County. Bolado Park on right.

New Pinnacles Highway Opened

By EDWARD J. NERON, Deputy Director of Public Works

THE completion and dedication of another section of State Highway Route 119, covering that portion lying between Tres Pinos and Paicines in San Benito County, occurred on Sunday, July 24th. This section of highway, known locally and advertised as the "Pinnacles Route," connects Hollister, the county seat of San Benito County, with the Pinnacles National Monument.

The formal dedication was held at the northerly end of the recently completed contract, which is at the southerly limits of Tres Pinos. The ceremonies at this point were brief and consisted of short talks by H. R. Judah, Chairman of the California Highway Commission, and Deputy Director Edward J. Neron representing Governor Frank F. Merriam and Director Earl Lee Kelly of the Department of Public Works. Cutting of the ribbon and the breaking of a bottle of wine of local vintage by Mr. Neron inaugurated the opening of the highway.

Following the opening ceremonies an automobile procession formed and proceeded over a portion of the new highway to Bolado Park, a beautiful San Benito County recreation spot where a barbecue luncheon was served to the many guests of San Benito County in a large pavilion.

Public appreciation of San Benito County citizens for the improvement by the State of this road to the National Monument was evidenced by the very large assemblage at the dedication and barbecue. An actual count showed more than 2000 people present at the fete which was handled with the utmost efficiency.

J. M. (Jake) Leonard, State Assemblyman for San Benito and Santa Cruz counties, who acted as Master of Ceremonies, introduced many visiting guests and called on various public officials for speeches.

The following County, State and Federal officials were introduced and spoke: J. F. Etcheverry, San Benito County Supervisor; W. I. Hawkins, Custodian Pinnacles National Monument; Congressman John J. McGrath; Miss Tickle, representing State Senator Ed. Tickle of Monterey and San Benito counties; State Senator James B. Holohan of Santa Cruz County; Phillip A. Stanton, State Highway Commissioner; Mrs. E. M. Brown, formerly of State Park Commission; Timothy A. Reardon, Director of Industrial Relations; L. V. Campbell, Engineer of City and Cooperative Projects, Division of Highways; H. R. Judah, Chairman of Highway Commission; L. H. Gibson, District Engineer and L. E. McDougal, District Office Engineer of District V, and the writer.

(Continued on page 12)



View of another section of new highway between Paicines and Tres Pinos on route to Pinnacles National Monument.



Realignment between Tres Pinos and Paicines in San Benito County. Black line indicates new highway in comparison with old.

The persons who participated in the ribbon cutting ceremonies at the official opening of the new Pinnacles Route Highway shown in the group below are, left to right: Lizzell Faxon; Congressman John J. McGrath; L. V. Campbell, Engineer of City and Cooperative Projects; Edward J. Neron, Deputy Director of Public Works; J. W. Trask, Assistant Engineer of City and Cooperative Projects; Barbara Turner; H. R. Judah, Chairman California Highway Commission; Betty Williams and Philip Stanton, Member California Highway Commission.





Another new section of route through the hills to Pinnacles National Monument. Note pleasing appearance of rounded slopes.

The talks by the visiting members of the Department of Public Works seemed to be particularly interesting to the assembled citizenry and were greeted with much applause.

State Highway Route 119 referred to locally as the "Pinnacles Route" was taken over by the State from San Benito County in 1933. The major portion of the traffic using this route consists of visitors to the Pinnacles National Monument which is about 35 miles south of Hollister. This National Monument, includes several hundred acres, and has been a point of interest for years because of the very unusual rock formations including two clusters of towering rocks referred to specifically as the Pinnacles. This area was made a National Monument some years ago and has been under the custodianship of W. I. Hawkins most of that time. Mr. Hawkins has been instrumental in obtaining the expenditure of considerable sums of Federal money within that area in the construction of roads, camp grounds, etc., that are very well equipped to take care of visitors for any length of stay. The records show that a large number of tourists visit the park.

State Highway Route 119 extends from Gilroy on the Coast Highway (US 101) through the city of Hollister and up the San Benito River Valley and Lewis Creek to a junction in Priest Valley with the lateral road connecting the San Joaquin Valley by way of Coalinga to the Coast Highway (US 101), a total distance of about 80 miles, most of which is in San Benito County.

The section dedicated is the second major construction project on this part of the road since it was taken into the State Highway System. In 1936 a portion of the road referred to locally as the Bear Valley Grade was reconstructed for a distance of 3.1 miles at a cost of approximately $110,000. This contract eliminated the worst portion of the section between Hollister and the Pinnacles National Monument.

The newly completed project brought to a higher standard that portion of the old road which had been at various times made impassable by high water in Tres Pinos Creek. The southerly terminus of this project is in the vicinity of the community of Paicines which is located at the Junction of Panoche Valley Road, a part of the county highway system. From this point this route follows generally in a northerly direction more or less paralleling Tres Pinos Creek, passing close by Bolado Park, and has its northerly terminus at the southerly end of the town of Tres Pinos.

The total length between termini is 5.2 miles, but an exception to the contract about ½ mile in length was made in the vicinity of the crossing of Tres Pinos Creek as funds were not available to build a new bridge at that location, so that the total improved mileage is 4.7 miles.

This section was graded to a width of 26 feet with surfacing of the road-mixed type 24 feet in width. The minimum radius curvature of 800 feet and the maximum gradient of 5.3 per cent with a total of only thirteen curves, briefly indicates the comparatively high standard of this new construction for a secondary highway. The alignment and grade is of modern standards and this new project shortens the distance between the above mentioned termini about one-half mile. N. M. Ball Sons of Albany were the Contractors on this section of road, having been the low bidder against 15 other Contractors. The State was represented on this work by Fred C. Weigel who acted as Resident Engineer.

As noted above, the old highway between the termini above mentioned, was frequently subject to damage during high water in Tres Pinos Creek and while the new alignment was so placed as to offer less hazard from such damage, it was anticipated that protection of some nature should be included to further safeguard this new construction before the coming winter. Accordingly, plans have been completed for sacked-concrete and brush fence protection. This was not made a portion of the grading and surfacing contract as it was decided to study the ravages of this stream during the high water period with relation to the new alignment.

New Traffic Survey Maps Show Homes, Schools, Gas Stations, Etc.

By T. H. DENNIS, Maintenance Engineer

IN MAY, 1936, the Division of Highways, cooperating with the Bureau of Public Roads, undertook a highway planning survey to establish facts essential in the selection of an integrated road system, and to indicate both the priority and the costs of improvement. Three studies were projected—a road inventory to take stock of the existing highway facilities, and traffic and financial studies to ascertain their use and cost. This article deals with the phase first commenced, the Road Inventory.

In July, 1936, twenty-four reconnaissance parties were sent into the field to log all roads that could be traversed, and to record their general condition—the type of surface and the main characteristics of roadbed, alignment, gradient, and drainage. Naturally, emphasis was upon public roads, and those of private ownership and use were excluded as far as possible. By the time logging was completed in May, 1937, the field parties had traveled 287,202 miles and had logged 86,924 miles of local roads in addition to the State highway.

QUESTION OF PRECISION

A word of caution is necessary as to the significance of this total of rural road mileage. To engineers, particularly, the exactitude with which it is stated is suspected on the grounds that men and machinery err; that survey distances differ from odometer readings (both have been used, although the latter predominate), and road mileage, too, is constantly changing. Obviously the precision with which the rural road mileage is indicated—and it is done solely as a matter of convenience in casting up the accounts—is impossible to attain. Deficiencies of this sort are minor when the broad aim of the survey is considered. Questioning the degree of refinement does, however, lead to two consequential qualifications that are less obvious.

First, it can not be said that all public roads are traversable by automobile. Often property is dedicated for a road and considered by some authorities to be such even though no traveled way is constructed. Again, there are many miles of road in the forests, which are closed during the fire season although they are quite capable of accommodating traffic. In making the road inventory, such cases were of necessity ignored.

ROADS NOBODY CLAIMS

Conversely, and still remembering that roads which are manifestly private are excluded, it is essential to note that all roads that can be traveled are not public roads. Reasonable investigation of 17,292 miles of the local roads fails to disclose any governmental unit sufficiently interested either to maintain or to claim them. They appear, nevertheless, to be public. Most of them are of low-type, but some are well improved and in either event motorists probably consider them as public roads.

Roads of this kind were included in the inventory for the sound reason that they are sources of rural traffic, and one of the necessities of the study was to note the existence of improvements that might affect the comings and goings of people. Thus, the locations of farms, dwellings, businesses, schools and similar gathering places were noted by the field parties, later to be plotted on maps.

In January, 1937, while the field work was still in progress, preparation of a base map of California was commenced. This base map consists of 303 sheets, of which 283 are on a scale of one inch to the mile, and 20 sheets on four times that scale. The latter sheets cover the thickly settled portion of Los Angeles County, southerly from the Sierra Madre to the Pacific Ocean, and westerly from the Orange County line to the Santa Monica Mountains. Individual sheets are a yard square, and although two or three sheets suffice for a majority of the counties, thirty sheets are required for San Bernardino. This map, now 87 per cent complete, will be finished September 1.

WEALTH OF DETAIL

All maps have the common purpose of showing position, direction, and distance, but the treatment of culture features customarily varies widely. Some may emphasize property lines, others railroads, or gasoline service stations. The base map is no exception in this respect. Its chief characteristics are uniformity of treatment as to scale and conventions, and a wealth of cultural detail.

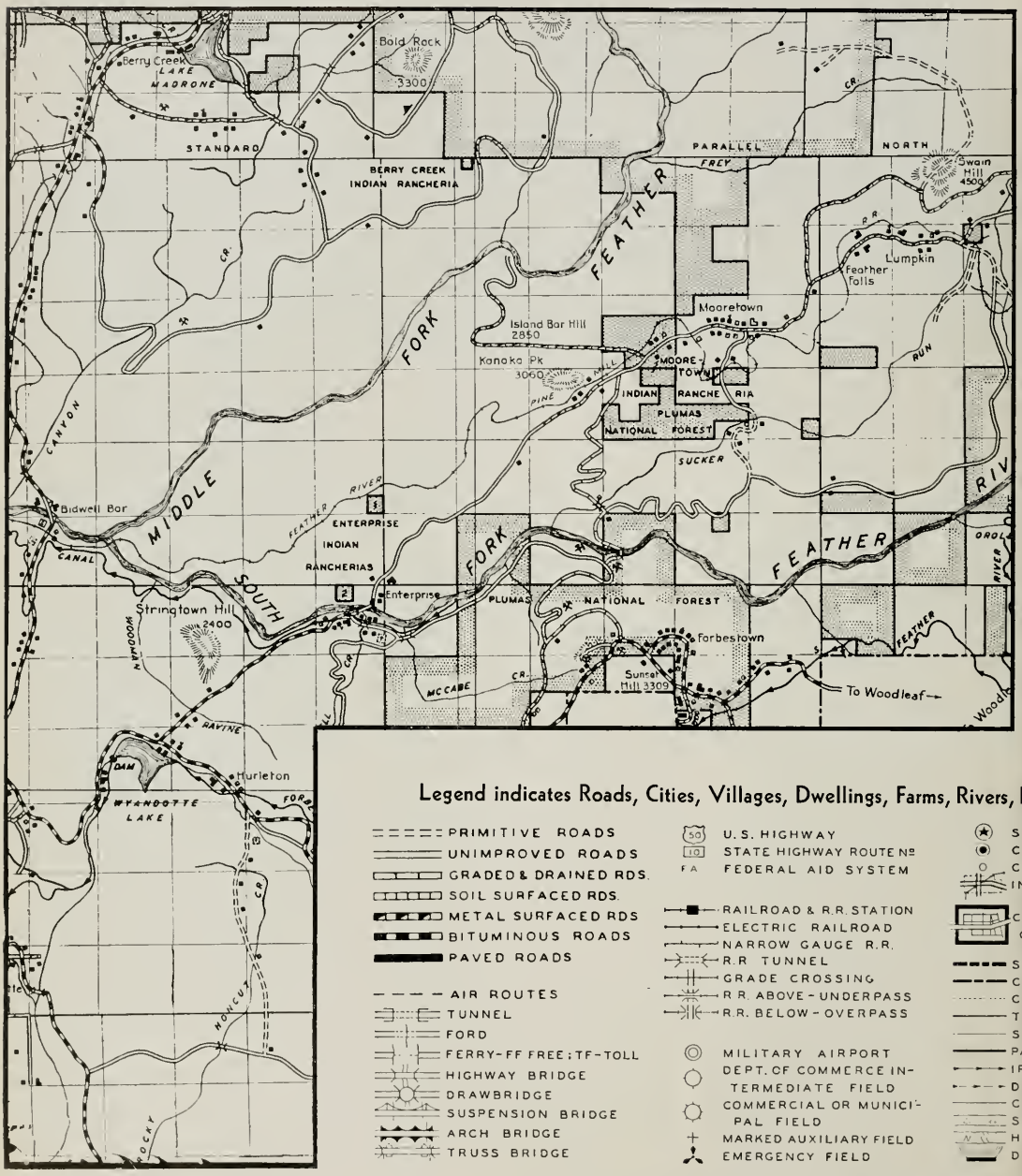
The farms and similar man-made improvements noted by the field parties have been traced and are distinguished from one another. Natural features are delineated sufficiently to indicate topography and drainage, yet these are not emphasized at the expense of culture for both are equally subservient to the main purpose which is to present naturally and logically the chief facts indicating the present road facilities and their use.

An additional attribute of the base map is that no legend is shown within the roadbands; thus, on copies of it, different legends are being used for a variety of purposes. The General Highway map, of which small portions of two sheets are shown on pages 14 and 15, presents the kinds of surfaces on the rural roads and their urban connections. This particular series will probably have the most general service of any of the series.

Three other series, identical except for the legends used in the roadbands, are designed to reveal special uses of the roads. The School Bus

(Continued on page 18)

Two Reduced Sections of State Highw

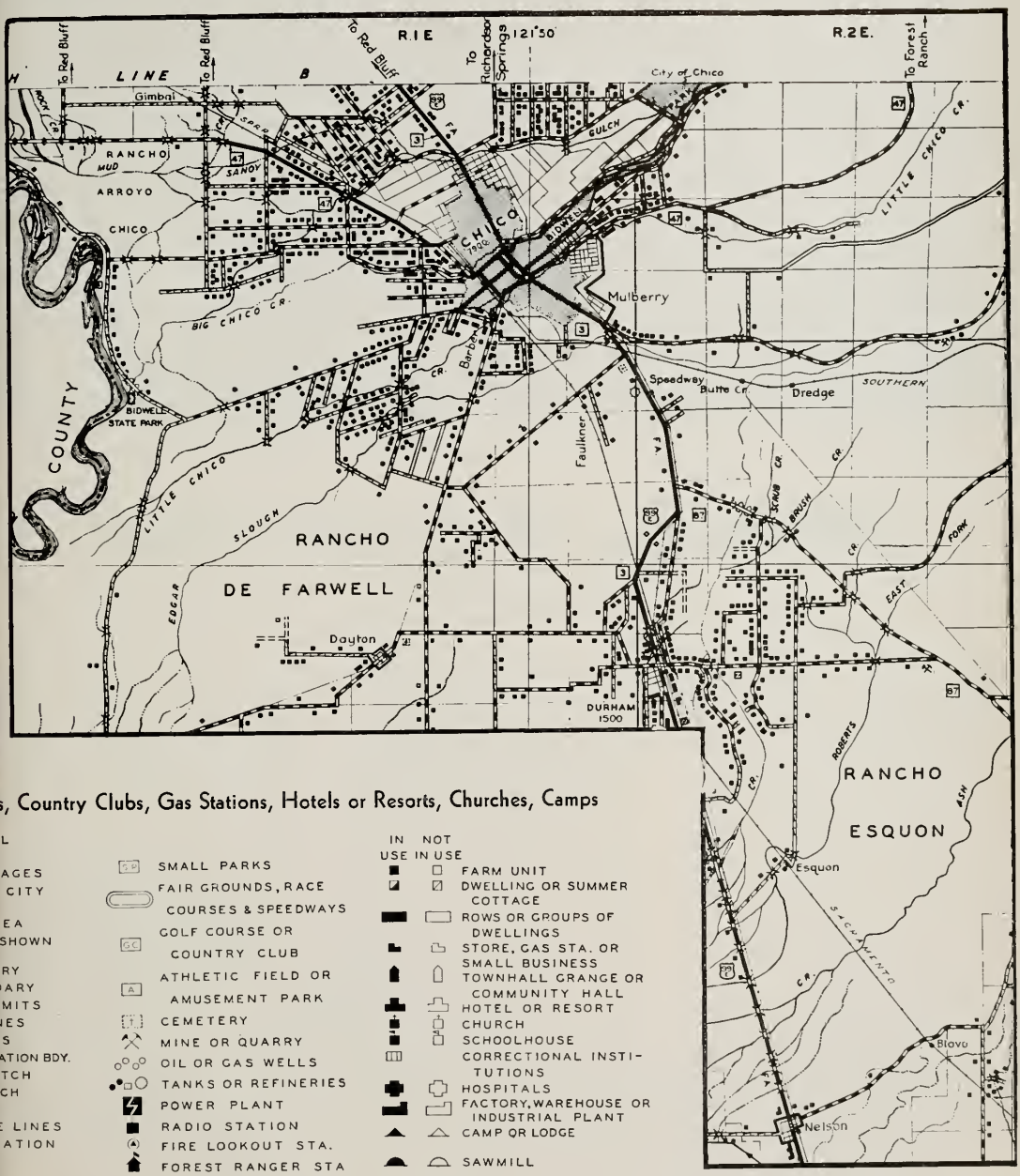


Legend indicates Roads, Cities, Villages, Dwellings, Farms, Rivers, Bri

- PRIMITIVE ROADS
- UNIMPROVED ROADS
- GRADED & DRAINED RDS.
- SOIL SURFACED RDS.
- METAL SURFACED RDS
- BITUMINOUS ROADS
- PAVED ROADS
- AIR ROUTES
- TUNNEL
- FORD
- FERRY-FF FREE; TF-TOLL
- HIGHWAY BRIDGE
- DRAWBRIDGE
- SUSPENSION BRIDGE
- ARCH BRIDGE
- TRUSS BRIDGE

- U. S. HIGHWAY
- STATE HIGHWAY ROUTE Nº
- FA FEDERAL AID SYSTEM
- RAILROAD & R.R. STATION
- ELECTRIC RAILROAD
- NARROW GAUGE R.R.
- R.R TUNNEL
- GRADE CROSSING
- R R. ABOVE-UNDERPASS
- R.R. BELOW-OVERPASS
- MILITARY AIRPORT
- DEPT. OF COMMERCE INTERMEDIATE FIELD
- COMMERCIAL OR MUNICIPAL FIELD
- MARKED AUXILIARY FIELD
- EMERGENCY FIELD

Planning Survey Map of Butte County



rks, Country Clubs, Gas Stations, Hotels or Resorts, Churches, Camps

- FAL
- ET
- LAGES
- D CITY
- AREA
- T SHOWN
- DARY
- NDARY
- ELIMITS
- INES
- IES
- ITVATION BDY.
- DITCH
- TCH
- GE LINES
- IGATION

- SMALL PARKS
- FAIR GROUNDS, RACE COURSES & SPEEDWAYS
- GOLF COURSE OR COUNTRY CLUB
- ATHLETIC FIELD OR AMUSEMENT PARK
- CEMETERY
- MINE OR QUARRY
- OIL OR GAS WELLS
- TANKS OR REFINERIES
- POWER PLANT
- RADIO STATION
- FIRE LOOKOUT STA.
- FOREST RANGER STA

IN USE	NOT IN USE	
■	□	FARM UNIT
◪	◪	DWELLING OR SUMMER COTTAGE
▬	▭	ROWS OR GROUPS OF DWELLINGS
▙	▙	STORE, GAS STA. OR SMALL BUSINESS
▮	▯	TOWNHALL GRANGE OR COMMUNITY HALL
▟	▟	HOTEL OR RESORT
▪	▫	CHURCH
▪	▫	SCHOOLHOUSE
▥	▥	CORRECTIONAL INSTITUTIONS
✚	✚	HOSPITALS
▬	▭	FACTORY, WAREHOUSE OR INDUSTRIAL PLANT
▲	△	CAMP OR LODGE
◓	◓	SAWMILL



Thirty-three foot finishing machine spreading leveling course at end of asphalt concrete surface run on State Highway 101.

Widening El Camino Real

By H. S. PAYSON, Resident Engineer

EL CAMINO REAL, or U. S. Route 101, in Santa Clara County, was widened to three 10-foot lanes between San Jose and Coyote during the summer of 1937. A widening and resurfaeing project now in progress continues the three-lane pavement south to a point six miles north of Gilroy. The project is 10.9 miles in length and extends from Coyote to a point one-quarter mile south of Llagas Creek.

The existing pavement, exeept for the section through Morgan Hill, was Portland cement concrete 15 feet wide and 4 inches thick eonstrueted in 1914 and 1915. In 1920 and 1922, concrete borders 2½ feet wide and 6 inches thick were added and the original pavement was covered with approximately three inches of asphalt conerete. Due to very heavy traffic loads, this light pavement has become extremely rough.

The traffic load carried by this pavement has steadily increased in volume and weight. Today peak loads on Sundays and holidays exceed 9000 vehicles, with enough heavy trucks to materially slow down traffic on the existing two-lane section. On week days traffic eounts show in exeess of 6000 vehieles, approximately one-fifth of which are trucks. Over one-half of the truck load consists of fast, heavy trucks.

Right of way has been secured to provide for ultimate eonstruction of a four-lane highway, with provision made in the present 33-foot width for a future dividing strip when the additional lane is eonstructed. Through the eity of Morgan Hill the existing eurbs provided a 60-foot roadway. New right of way was seenred to provide a street width of 90 feet between eurbs, which will provide for two parking strips along the eurbs, four 11-foot lanes, and a dividing strip in the center.

With the exception of the city of Morgan Hill and additional widths provided to conform to the existing pavement at the Madrone Underpass (which was completed in 1933) and the new bridge being constructed across Llagas Creek, the pavement will be uniformly 33 feet in width. Through the city of Morgan Hill asphalt concrete pavement 23 feet in width will be placed, with a road-mix surface on either side, to remove the existing high crown and smooth up the exceedingly rongh street.

Alignment throughout the project is good, and only two line changes will be made. Between Stations 12 and 26 and Stations 106 and 127, Section C, the existing 900 foot and 1000 foot radius curves will be replaced with 3000 foot radius curves.

Drainage conditions, due to location of the highway on the floor of the Santa Clara Valley, have been inadequate to prevent flooding of the roadway during yast years. Those



Business section in Morgan Hill showing buildings set back to permit highway widening.

sections most subject to flooding are being raised. Also, a large number of additional, or larger, corrugated metal and concrete pipes are being provided to remove storm waters from the right of way as soon as possible directly through orchards to natural drainage channels.

NEW BRIDGE INCLUDED

The existing bridge across Llagas Creek has been the scene of numerous accidents due to location on a sharp curve with impaired sight distance, a narrow roadway surface, and a crowned roadway section. This bridge will be replaced by a rigid frame structure on a new location with adequate width and superelevation and satisfactory sight distance.

Through the business section of Morgan Hill all buildings on the west side of the highway have been moved and rebuilt in their new location. The addition of new fronts with fresh plaster and paint, in conjunction with the better appearance of the widened street, will give Morgan Hill a vastly improved appearance.

Pavement is being laid in 33-foot widths, with traffic being carried along the borders while paving operations are in progress. Only minor delays have occurred due to this method of caring for traffic.

AUTOMATIC MIXING PLANT

The asphalt concrete plant located in the Pacific Coast Aggregates Company's yard at Coyote is constructed to proportion the mineral aggregate automatically. The multiple beam scales are controlled by electric eyes which allow discharge from one bin only at a time, and a very uniform proportioning of materials is obtained. A time clock insures full mixing time in the pugmill. The time of weighing approximates closely that of hand operation.

Good progress is being made on the project, and it is anticipated that it will be completed within the time limit of 175 working days.

The contract was awarded on April 25, 1938, to Jones and King of Hayward, California. Asphalt concrete paving was started on June 23, 1938, and is progressing south at the rate of approximately 1000 lineal feet per day. The work is being performed under the direction of Jno. H. Skeggs, District Engineer.

Shovel removing surplus excavation while trucks are placing borrow material along newly widened section of roadway.



Relation of Scientific Engineering to Accident Prevention

(Continued from page 9)

demanded of the highway engineer. That highways can not be satisfactory if they are unreasonably hazardous is not open to question. Equally true is the statement that a highway must provide many other features besides safety in order to be satisfactory.

No one is more seriously concerned over traffic accidents than the highway engineer, nor does anyone have a higher regard for life and security against injury. No arbitrary value in dollars and cents can be placed on these things; and the engineer will not allow himself to be charged with any attempt to do so. He is, however, most insistent that whatever funds there are available primarily for safety features be used for those things that offer most in returns in accident prevention or reduction. It is in the search for such means and their application that the relationship of scientific engineering to accident prevention is best exemplified.

The problem is far from simple. There is no single formula or set of formulas that can be set up as final and not subject to modification.

Elements may be incorporated into highway design which unquestionably create a higher standard of safety than that which may now be present on a particular road—a higher standard of safety in this respect: that if the same amount of care will be exercised by motorists on the improved road that is used on the road in its present condition, the number of accidents will be reduced.

MOST PERPLEXING PROBLEM

If, however, the motorists demonstrate by their actions that other things are more desirable than safety, they may very easily by an unreasonable increase in speed and carelessness make the improved road more hazardous than it was before. This not only can happen but does happen. If it were caused by a few incorrigibles, the engineer would not concern himself; but when the average motorist reacts in this manner and completely nullifies the efforts of the engineer toward decreasing the accident rate, a very perplexing problem is presented.

The highways must be designed and constructed for the average motorist. The highway engineer can acquire neither credit nor satisfaction by building roads which may be admittedly better from a purely physical standpoint, if at the same time they prove to be unsatisfactory in operation because of high accident frequency.

It will never be possible to prevent all accidents wholly by physical means, although highway engineers may sometimes feel that is what the public demands of them.

While recognizing that there are limits to what can be done by engineering, there must not be developed too strong a disposition to decide offhand that this or that type of accident is not in any sense an engineering problem.

The successful engineer must know, as fully as it is possible for him to know, how the average motorist reacts to the various physical highway characteristics. This knowledge is just as essential as that he be conversant with the abstract laws of physics.

Features of design that not only permit but encourage higher speed, call for all the additional features needed to assure safety at these increased speeds. The average motorist has a thousand foibles for which the engineer can not fully compensate in his design; but where a reasonable degree of compensation is practicable, it can not be neglected on the ground that the motorist should overcome his own weaknesses. There will always remain too many situations where the engineer can be of no assistance.

(To be concluded in a later issue)

CHAIRMAN JUDAH OPENS OFFICE

Chairman H. R. Judah of the California Highway Commission has opened an office for the transaction of highway business on the mezzanine floor of the Hotel Palomar at Santa Cruz, in which city Mr. Judah lives. He has been connected with the publication of the Santa Cruz Daily News for many years.

New Maps Show Homes, Schools, Etc.

(Continued from page 13)

map covers the routes followed by the 2200 rural school buses in California. The Postal Route map distinguishes between the Rural Free Delivery and Star Mail routes. A Truck and Bus map will show the courses followed by common carriers.

Complete though these maps are, there is still missing a link in the evidence required. A traffic map giving the aggregate daily flow of all kinds of vehicles is therefore being made to supplement those series limited to special uses of the roads. The Traffic map is being compiled from the results of 11,900 traffic counts taken at 6400 rural traffic stations.

The General Highway map, the School Bus map, and the Postal Route map will be available November 1; the other series will follow. Taken in conjunction with one another and with tabulations that are being prepared, they will undoubtedly make it possible for highway administrators to visualize more clearly the complex nature of California's road problems and to bring thinking on these matters into sharper focus.

TREASURE ISLAND CONTRACTS

Two contracts for work on the California State Building, Golden Gate International Exposition, on Treasure Island, were awarded by Director of Public Works Earl Lee Kelly on August 1.

One contract for $13,289 was awarded to Spencer Electrical Company of San Francisco for the electrical work, and the other for plumbing, heating, and ventilating work was awarded to O'Mara and Stewart, Ltd., San Francisco, at $29,674.

A denizen of the hills of East Tennessee, who was appearing as a witness in a lawsuit, was being questioned as to his educational qualifications by the plaintiff's lawyer.

"Can you write?" asked the lawyer.

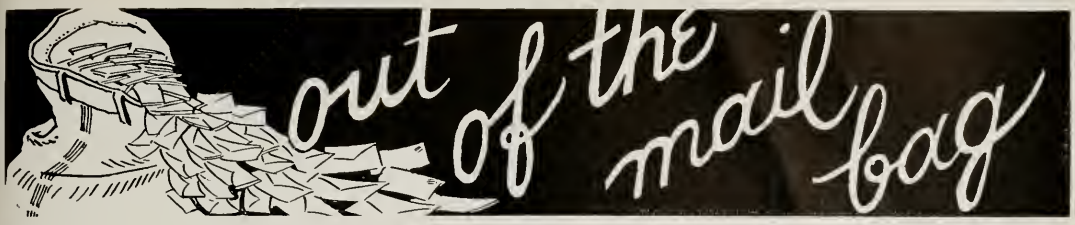
"Nope."

"Can you read?"

"Wa'al I kin read figgers pretty well, but I don't do so good with writin'."

"How is that?"

"Wa'al, take these here signs along the road when I want to go somers; I kin read how fur, but not whurto."



United States Post Office

Anaheim, Calif.

Mr. S. V. Cortelyou,
Los Angeles,
California.

Dear Sir:

I want to thank you on behalf of our rural carrier for your decision to construct the detour at Yorba bridge. It saves him 12 miles every time he covers his route and is quite a convenience to many ranchers on both sides of the river nearby. We all appreciate your heavy expenses in repairs due to last winter's floods and are very grateful for your cooperation in this matter.

Yours truly,

(Signed) LOUIS H. HASKINS,
Postmaster.

Ventura Junior College

Ventura, California

California Highways
and Public Works,
Sacramento, California.

Gentlemen:

Will you please place our school on the mailing list for your magazine?

Sincerely yours,

(Signed) D. R. HENRY,
Principal.

DRH:gh

Met Traditional Courtesy

California State Highway Department,
Sacramento, California.
Att: Supt. in charge of Dept. Foreman.

Dear Sir:

I am an automobile gypsy! I travel our great western areas from north to south and east to west. In these travels, I meet many men—some are merely human beings—some are cold and sarcastic in their contact with strangers—while some are worthwhile men with a love for their fellowman.

It was my misfortune some days ago to have a rather severe accident to my car about ten miles from Lost Hill, near Bakersfield. I met Mr. J. F. Shedd, your foreman, at that point. Mr. Shedd is one of the few who are really worthwhile. The courtesy, consideration and assistance that he gave me was of the extreme and he gave it to me freely.

I am writing this to call your attention to this man for he is exceptional, and I trust you will give him all consideration possible.

Thanking you for your attention in reading this letter, I am,

Yours sincerely,

(Signed) W. S. PARK.

Spreads Good Will

Oakland, California.

Department of Public Works,
Sacramento, California.

Gentlemen:

I am very much interested in your magazine "California Highways and Public Works." At every opportunity I try to grab it as it comes in the mail; unfortunately for me there are others with the same idea in mind.

I wish to express my appreciation for your publication. It spreads good will and gives all who see and read it a better understanding of highway problems.

Sincerely yours,

W. J. RILEY.

WJR:mvh

An Appreciation and Reply

Mr. Earl Lee Kelly,
Sacramento.

Dear Mr. Kelly:

While driving along the new Coast Highway between Carmel and San Luis Obispo last Sunday, I encountered motor trouble near the residence of one of your engineers, Mr. Patrick Cordero.

I want to take a few minutes to commend Mr. Cordero for his assistance to me in my distress. As neither of us could repair the car, he took the trouble of driving me fourteen miles to get a mechanic, as there was no telephone within that distance. The accident happened just about sundown, and I thought I was surely in for a miserable night.

The next time you get in touch with Mr. Cordero I wish you would extend my heartfelt thanks to him.

Very truly yours,

(Signed) JAMES P. LANGLEY.

Mr. James P. Langley,
Berkeley, California.

Dear Mr. Langley:

I have received your letter of recent date in which you compliment one of the employees of the Department of Public Works.

It was very nice of you to write to me and you may be very sure that I will see that Mr. Cordero's immediate superior is informed of the gracious treatment he endeavored to extend to you.

Sincerely yours,

EARL LEE KELLY,
Director of Public Works.

Watsonville, California.

Editor California
Highway Magazine.

Dear Sir:

I enjoy your magazine very much. I think it is a wonderful publication, also it is wonderful what your Department of Public Works is doing in our great State.

Thank you for sending it to me.

Very truly yours,

(Signed) GEORGE H. WINCHELL.

Interesting and Instructive

Calif. Highways
and Public Works,
Sacramento, California.

Gentlemen:

I have been the recipient of several recent copies of "California Highways and Public Works" and I am asking that my name be added to the mailing list for a monthly copy of this interesting publication, if consistent with your policy.

As a motorist, I find the magazine very instructive, presenting as it does the many difficulties encountered in the Department's efforts to complete the finest highway system in the world, and your engineers' initiative in overcoming them.

Yours very truly,

(Signed) O. L. EMIG,
San Mateo, California.

Stranded Motorist Helped

State of California
Department of Education

To the Director of State Road
Maintenance Division,
Redding, California

Dear Sir:

While returning by auto from Quincy, an oil line broke and I was stranded on the Feather River Highway. One of your men, Mr. Stanley Lambert, of Pulga, came to my rescue and was most courteous and helpful giving several hours of his day off to help me reach Oroville. I am, and was, deeply grateful and wish you to know of his kindness and generosity.

Sincerely yours,

(Signed) WINIFRED VAN HAGEN

Funds Lacking for State Highways and Bridges

(Continued from page 3)

$2,736,700 with an average of $1,547,100 per fiscal year.

It is noted that the highest expenditure was in the 83d fiscal year prior to the addition of 6600 miles of county roads to the State Highway System. The year of lowest expenditure was the 87th fiscal year which ended June 30, 1936.

Assuming that construction funds will be allocated to the district at the rate of $1,547,000 (the average for the past nine years), it will take approximately 28 years to accomplish the work listed above amounting to $44,000,000.

It is apparent that sufficient construction funds cannot be obtained to provide the facilities listed above in the immediate future, but it seems imperative that some program should be adopted by which construction can be accelerated to a degree which will insure a gain of road improvements over loss by obsolescence and deterioration. The roads in this district are now at about the balance point between these factors and are on the down grade toward the latter.

Construction funds in an amount about double those allocated to the district for the past few years would weigh the balance in the proper direction.

INTER-AMERICAN TRAVEL CONGRESS

Preliminary agenda for the first Inter-American Travel Congress, which will be held at San Francisco April 14 to 21, 1939, indicate that a broad range of topics will be covered by delegates from every nation of the three Americas, whose objective will be the smoothing of travel barriers between the countries.

The congress, sponsored jointly by the Pan American Union and the Golden Gate International Exposition, will be held as a part of the Western World's Fair on Treasure Island in San Francisco Bay. Enthusiastic support has been given by all the nations of North, South and Central America, and with distribution of the preliminary agenda now under way, the program is taking firm shape.

Betty—Why do you wear such loud socks?
Bobby—To keep my feet from going to sleep.

An Appreciation

649 S. Olive Street,
Los Angeles, California,
July 28, 1938.

Mr. John W. Howe, Editor
California Highway and
Public Works,
Sacramento, California.

Dear Mr. Howe:

Some three years ago Mr. Earl Lee Kelly, Director of the Department of Public Works, at my request kindly had my name placed on the mailing list to receive your most interesting and instructive magazine. His courtesy in this matter is sincerely appreciated, for of the many publications I read there are two I look forward to receiving more than all of the others—one is your publication and the other is the National Geographic.

Since receiving your Official Journal I find that I take greater interest in the development of our highways and natural resources than ever before. Your interest in public welfare and the protection of human lives is deserving of highest commendation. The steady and consistent improvement in type of construction, with safety provisions, in the new highway development work is very commendable.

The rapidity with which the Department of Highways came to the aid of distressed districts at the time of the floods of last Spring is ample proof of the far reaching good which can be accomplished through coordinated efforts.

This question comes to my mind—How extensive is the use made of your publication in the school systems of our State? Has this phase ever been brought to the attention of Dr. Dexter or Dr. Sproul? I do not know of any other magazine published which gives a better geographical understanding of the various parts of the State than your booklet.

Governor Merriam's recent statement regarding the new development work in the San Bernardino Mountain area is intensely interesting to us in the southern part of the State. This realignment will permit easy and safe ingress and egress for residents of Southern California to the great San Bernardino Mountain recreational areas and save as much as thirty to forty minutes time in transporting fire fighting equipment from the Valley floor to the forests.

The courteous and efficient manner in which the employees of the Highway Department handle traffic at detours or places under repair is most praiseworthy. We are indeed fortunate in having such a fine organization as the Department of Public Works of California.

Yours sincerely,

AUTHOR O. GARRETT,
Tax Representative Bank of America and Capital Company, Los Angeles, Calif.

Good Roads Bring Visiting Throngs to State Fair

SACRAMENTO will truly become the heart of the State as traffic on all highways will lead to the California State Fair and Exposition, to be held September 2d to 11th inclusive.

No part of the State is better situated in regards to roads. Direct arteries from the north and south, east and west, are ready to carry what Secretary-Manager Robert Muckler expects to be a record attendance.

Each year during State Fair time, people in every county of the Seate are made conscious of the benefits of a unified highway system which permits easy travel from every section of California right to the gates of the fair grounds.

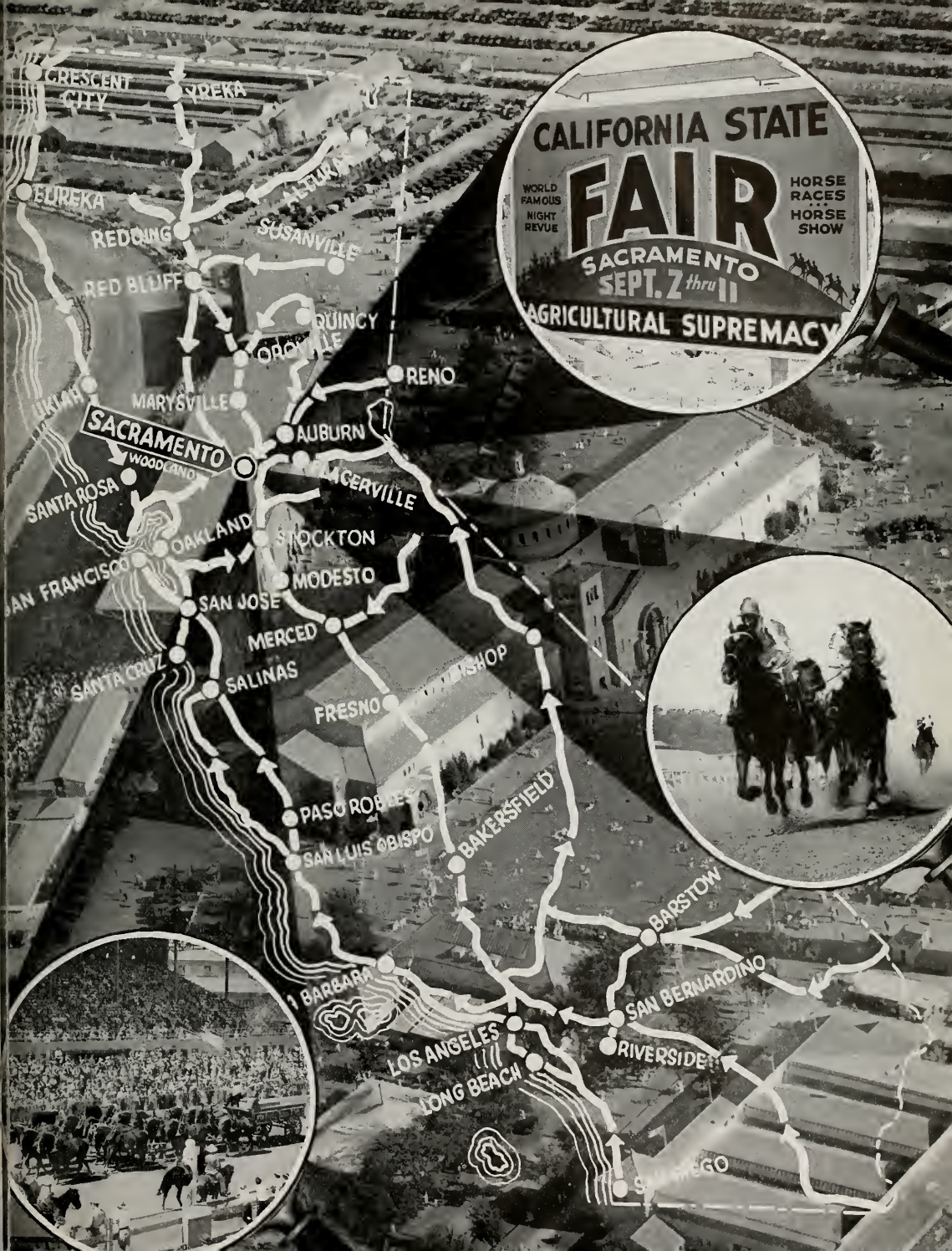
This year, visitors from the San Francisco Bay region will be able to travel over the new Altamont Pass Highway, recently completed at a cost of $1,205,401.

Eliminating 45 dangerous curves, the new Altamont Highway, a two-lane divided road, will afford State Fair visitors from Oakland and other East Bay points a quicker and safer route to Sacramento.

The network of highways leading to Sacramento, under the administration of the Division of Highways of the Department of Public Works and the California Highway Commission, has been brought to safety and comfort standards compatible with the development of modern motor vehicles.

Easy transportation of exhibits, coupled with additional electrical wiring and display improvements, is bringing a record increase in entries, especially from small individual ranchers and live stock men.

Some of the factors expected to attract visitors from even the most outlying districts are a $1,000,000 building and improvement program: An outstanding racing program for $50,000 in purses; larger and more artistic exhibits by California's counties; the $2,000,000 live stock parade and farm machinery show; the world-famous outdoor night revue, augmented by a chorus of 250 voices, and the nationally recognized Horse Show.


CALIFORNIA STATE
FAIR
WORLD FAMOUS NIGHT REVUE
HORSE RACES
HORSE SHOW
SACRAMENTO
SEPT. 2 thru 11
AGRICULTURAL SUPREMACY
CRESCENT CITY
EUREKA
REDDING
RED BLUFF
SUSANVILLE
QUINCY
RENO
MARYSVILLE
SACRAMENTO
WOODLAND
AUBURN
SANTA ROSA
OAKLAND
STOCKTON
MODESTO
SAN JOSE
MERCED
SALINAS
SANTA CRUZ
FRESNO
PASO ROBLES
SAN LUIS OBISPO
BAKERSFIELD
BARSTOW
SAN BERNARDINO
LOS ANGELES
LONG BEACH
RIVERSIDE

Coast Highway Along Malibu Reconstructed With Divided Lanes

By RALPH C. MEYERS, District Office Engineer

DURING the past few years the volume of traffic on the State highway which skirts the ocean shore between Santa Monica and Oxnard has increased to the point where it has become necessary to reconstruct the road at certain locations. In 1936 the section of this highway at the crossing of Walnut Creek was reconstructed on new location with a new bridge across the canyon about 19 miles west of Santa Monica.

On October 1, 1937, a contract was awarded by the Director of Public Works for construction on improved alignment and grade of 1.6 miles between Walnut Canyon and Trancas Beach and on October 26 a contract was awarded for similar reconstruction of 3.1 miles between Trancas Beach and Encinal Canyon. In conjunction with these road improvements the State entered into a third contract for the widening of the bridges across Trancas and Zuma Creeks.

ADEQUATE FOR TRAFFIC

Reconstruction under these contracts eliminates the most antiquated portions of the route and will provide roadway facilities of modern design capable of adequate service under present day traffic conditions.

In general the work has consisted of placing two 11-foot lanes of Portland cement concrete pavement with 28 feet of plant-mixed surfacing between them. The shoulders on each side of the pavement are being oiled for a width of 15 feet, making a total width of roadway of 80 feet or 28 feet on each side of curb.

DIVIDING STRIPS CONSTRUCTED

Throughout the length of the improvement a parting strip is being constructed on the central four feet of the 28-foot plant-mix surfacing. This strip will provide a divided pavement of four lanes, two for each direction of travel. The outside pavement lanes are 11 feet wide and the inside, or passing lanes, are 12 feet wide.

Two types of parting strip construction have been used in dividing the traffic ways. On the portions of the route which are not heavily populated the strip consists of concrete curbs four feet apart with the space between filled with soil planted to ice plant.



On portions of the route not thickly populated the division strips consist of concrete curbs 4-feet apart with planting between.



Division strip on this section will be 4-feet wide with raised white arrows bordered by double white lines.

This curbed type is being constructed on two sections, each approximately one mile in length. The curbed and planted dividing strip is broken at intervals to provide for necessary crossings.

Along the remaining portions, which are built up and populated, a dividing strip consisting of raised and painted diagonal arrows is used. This type is also four feet wide and consists of a double white traffic stripe on the outside borders, with raised arrows, painted white, placed within these stripes.

RAISED ARROW STRIPS

The arrows are set diagonally with the center line and alternately point in opposite directions. This type of dividing strip presents a roughened surface in the center of the pavement which discourages travel but does not prevent crossing the highway. The raised arrow type of traffic way separation has proven quite successful on portions of the Ramona Boulevard-Garvey Avenue route between Los Angeles and Pomona.

The reconstruction of this portion of the Roosevelt Highway will undoubtedly facilitate the movement of the large volume of traffic along the highway. The improved line and grade and traffic separation will provide for safer travel conditions.

The two road contracts are held by the Macco Construction Company of Los Angeles and the contract for widening the bridges across Zuma and Trancas Creeks was performed by John Strona of Pomona.

The estimated cost of the work included in the three contracts is $424,000 and it is anticipated that all work will be complete by September.

Bay Bridge Traffic Shows Increase

AN AVERAGE of 23,951 vehicles per day crossed the San Francisco-Oakland Bay Bridge during the month of July, it was announced by State Director of Public works Earl Lee Kelly from a monthly traffic report filed by State Highway Engineer C. H. Purcell. This was a slight increase over June, which had an average of 23,806 vehicles. However, it represented a drop of approximately 5000 vehicles per day from the same month a year ago, when automobile ferry rates were at a parity with the bridge. The daily average for July, 1937, was 28,582 vehicles.

There was a total of 742,472 vehicles in July crossing the bridge, as compared to 714,173 in the preceding month.

Total collections for the month of July were $386,723.15.

Trucks fell off last month from the preceding month, with a total of 34,414 for July and 35,530 for June, which was a day-shorter month.

Freight pounds also decreased in July, with 87,499,250 pounds, compared to 92,797,000 for June.

Total number of vehicles using the bridge for the first seven months of 1938 is 4,809,426. Since the bridge opened on November 12, 1936, 15,253,976 vehicles have crossed the span.

Comparative figures and totals follow:

	*Total July	*Total June	*Total since opening
Auto trailers	1,829	1,378	24,451
Passenger autos	667,608	641,653	14,220,259
Motorcycles	3,034	2,736	52,596
Tricars	1,001	1,102	16,123
Buses	13,467	11,273	180,600
Trucks	34,414	35,530	523,365
Truck trailers	1,538	1,588	31,171

*These totals exclude toll exempt vehicles.

"The boy who gets this job must be fast."

"Mister, I'm so fast I can drink water out of a sieve."

Casting Director—In this picture about Hollywood, I've cast you two fellows as assistant directors.

Actors—Yes.

Casting Director—Ah, I see you already know your lines.



These men, civil service employees, operate four tow cars and fire truck owned by Bay Bridge providing service for stalled motorists.

Motorists Get Quick Aid on Bay Bridge

MOTORISTS crossing the San Francisco-Oakland Bay Bridge may have the services day or night of a crew of 10 men, who operate the span's own tow trucks. Patrons of the bridge, stalled for any reason on its 4½ mile length, need only smash the glass-covered dial labeled "tow service" contained in one of the 33 red-colored boxes placed at convenient intervals along the north side of the upper and lower decks.

Within a few minutes a bridge tow car will come to the motorist's aid, equipped to provide him with gasoline, to change a tire, or to tow him off the span. A charge of 30 cents a gallon, with a minimum of three gallons, is made for gasoline.

Gallant bay bridge officials make no charge to women motorists for changing a tire, but levy fifty cents on men drivers.

It costs the small sum of $1.30 to have your automobile towed off the span within a convenient radius of either end of the bridge. Motorists belonging to automobile clubs may have their tow charges paid for by the club.

A fleet of three tow cars and one truck comprises the bay bridge's roadside service. The State's Vehicle Code does not permit a private towing service to operate on the bridge.

The tow-boxes, said to be the only ones of the kind, were essential because of the tremendous length of the bridge and the necessity to keep traffic moving on the great span.

Out of a total of 15,048,565 vehicles crossing the bridge since it was opened, 11,908 vehicles have received aid from the span's Roadside Maintenance Service, it was announced by Principal Bridge Engineer Chas. E. Andrew. This is equivalent to an average of 18.99 vehicles serviced per day, or one out of every 1,281 automobiles crossing the bridge.

More motorists were stalled on the bridge due to lack of gasoline than for any other reason, it was revealed, with 6,514 vehicles supplied with gasoline or oil. A total of 3,554 vehicles had been towed because of engine trouble, lack of spare tire, or accident; and 1,781 tires were changed on the span.

The bay bridge's own fire truck has extinguished a total of 59 vehicular fires, Mr. Andrew announced.

The San Francisco-Oakland Bay Bridge, U. S. Routes 40-50, is maintained and operated by the California State Division of Highways.

"Hey, mister! Your engine's smoking."
"Well, it's old enough."

Highway Commission Head Urges Necessity of Protecting Gas Tax

(Continued from page 7)

smallest amounts, in view of the extreme necessity for the use of every dollar for highway purposes must be definitely stopped.

Secondly, the people of California must hold tight to gasoline tax income for highway purposes because the outlook under existing conditions in this State for the use of this money to splendid advantage in the perfection of a co-ordinated highway system in the State, is *vitally imperative.* Earl Lee Kelly, Director of the Department of Public Works, on more than one occasion in public addresses has said that even today California is eight years behind in its highway development, as measured against the demands and necessities brought about through the tremendous increase in the registration of automotive units and the normal economic, population and industrial growth of the State.

California now has registered by its own automotive owners, one-tenth of all the cars and trucks in the entire United States. But that is only part of the story. California is the most widely patronized and extensively traveled world sector by the recreational motorist. These visitors, numbering in the first six months of 1938 524,375 persons, all traveling in automobiles, also pay their gasoline tax with every gallon they buy in the State.

Even adding to this, the tax paid by California motorists, still the amount of money realized from these sources is not sufficient today to properly round out a modern highway program in this State. All the more reason, therefore, that we should conserve and subserve every dollar of gasoline tax income through a constitutional restriction for the exclusive legal use of the money for highway construction, reconstruction and maintenance.

Some slight idea of what the future holds in highway development and its cost in this State, may be gleaned from the report recently released in the official magazine of the National Association of Highway Officials compiled from evidence and estimates given by the various states.

In the case of California it will be necessary within a reasonable period of time to rebuild 4600 miles of highway, to widen 1200 miles, to relocate 1000 miles and to widen or rebuild 2300 bridges. This program has an estimated cost of $420,000,000. California shows the most extensive future program of any State in the Union. Ohio is next with a necessary expenditure in the same period of $342,000,000.

It may be easily seen by the California voter that it is to his interest as a citizen and taxpayer to conserve gasoline tax money for highway purposes, exclusively. The money has been so well and capably spent ever since the formation of the State Highway Department, and the results in better business and general prosperity in the State have been so pronounced as a consequence, that no citizen need fear about voting "Yes" on the constitutional amendment.

Remember that in California more than in any other State in the Union, the gasoline tax is not a tax. It is a first rate investment for increased prosperity.

Decimal Point in Wrong Place Causes Gas Tax Shrinkage

In its official release to the press on July 27, 1938, the State Board of Equalization stated that the gasoline tax assessment for June, 1938, represented an increase of 3.35 per cent over the assessment for June of 1937. Actually the increase amounted to .33564 of one per cent or one-tenth of the amount quoted in the release. The inaccuracy in placing the decimal point creates an erroneous impression to the extent that an increase of 3.35 per cent would have amounted to $155,506 whereas the actual increase amounted to $15,535.43.

Assessments for the first six months of the current calendar year amounted to $24,997,853.22 as compared with $24,912,-117.43 for the corresponding period of 1937. The increase of $85,735.79 represents an increase of .344 of one per cent indicating that June was a typical month on the basis of the average for the first half of the year.

Asphalt Conference Will Be Held Oct. 10-13

The Montana National Bituminous Conference of 1938 will be held at Biloxi, Mississippi, October 10 to 13. The program is intended to cover all phases of asphalt usage and is divided into four sections as follows:

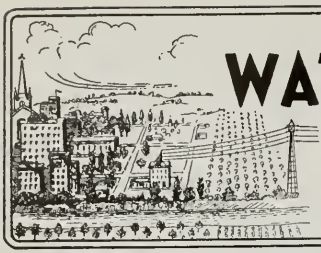
(1) Progress and research as related to construction and maintenance of bituminous surfaces; (2) Fundamentals of bituminous construction; (3) Construction of bituminous surfaces; (4) Maintenance of bituminous surfaces.

Chairmen of these sections are: (1) N. W. McLeod, Research Engineer, Department of Highways and Transportation, Regina, Canada; (2) T. E. Stanton, Materials and Research Engineer, Division of Highways, California Department of Public Works; (3) V. B. Steinbaugh, Deputy Commissioner-Chief Engineer, Michigan State Highway Department; (4) A. B. Nuss, State Highway Engineer of Kansas.

MOTOR TOURISTS INCREASE

Approximately 344,556 motor tourists visited California during the first third of this year, it is estimated by the touring bureau of the Automobile Club of Southern California. The figure represents over 16,900 more motor visitors from other states and countries than the tourist influx during the first four months last year.

The Eighteenth Annual Meeting of the Highway Research Board will be held on November 30-December 2, 1938, at the National Academy of Sciences, Washington, D. C.



DIVISION OF WATER RESOURCES

OFFICIAL REPORT

FOR THE MONTH OF

July, 1938

EDWARD HYATT, State Engineer



INVESTIGATIONS of applications for allotments from money appropriated to the Emergency Fund by Chapter 11, Statutes of 1938, Extra Session, for restoration of public property, levees, flood control work, county roads, and bridges, damaged by recent floods throughout the State, and the supervision of restoration work, have been continued by the Division of Water Resources representing the Department of Public Works, pursuant to instructions of the Director of Finance.

Reports and recommendations on 120 of these applications have been made by this Division and State Reclamation Board to the Director of Finance. Allocations totaling $2,225,000 have been approved by Governor Merriam. Some of the work under these allocations is being performed by the Division and other work is being done by the applicants under contracts with the Department of Public Works. Fifty-three contracts are now in force for work which will cost $1,500,000.

In the investigations of applications for repairs valuable assistance has been given by the Maintenance and Bridge Departments of the Division of Highways and the Bridge Department has aided greatly in the approval of plans for bridge repairs.

IRRIGATION DISTRICTS

Award of contract for construction of the first forty-three miles of the Coachella branch of the All American Canal, was announced early in the month from Washington. The branch will extend for more than 100 miles to a point north of Salton Sea and will provide irrigation for an area of some 350,000 acres, lying to the east of Imperial Irrigation District and within the Coachella Valley County Water District. The main section of the All American Canal, which was started in 1934, will be completed and placed in operation next year for service of the 500,000 acres now irrigated in the Imperial Valley from the old main canal that loops through Mexican territory.

San Dieguito Irrigation District has obtained assurance of Federal assistance in carrying out extensive improvements. Plans contemplate construction of two new pumping plants, an elevated steel tank of 75,000 gallon capacity, and a 200,000 gallon balancing reservoir. Estimated cost is $111,000.

SUPERVISION OF DAMS

Application has been received for the construction of the Rancho Del Ciervo Dam in Santa Barbara County.

Applications for the repair of Los Serranos Dam, Saw Pit Dam, Nelson Dam, Big Santa Anita Dam and Peoples Weir Dam have been received, of which Nelson and Los Serranos have been approved.

Applications are approved for construction of the Charles Lee Tilden Park Dam and for enlargement of Lower St. Helena Dam.

WATER RIGHTS

Thirty-five applications to appropriate were received during June. Eight were denied, ten approved and rights under ten permits were confirmed.

Project inspections preliminary to the issuance of license or revocation of permit were made in the San Bernardino area in the Sierras except the Tahoe and Mono Basin areas, and in Siskiyou and Tehama counties.

TOPOGRAPHIC MAPPING

Field work on the San Bernardino No. 3 and No. 4 quadrangles has been completed and office work has been completed on the Downieville No. 1, Avenal and Kramer No. 2 quadrangles, and is progressing on the Kramer No. 4 quadrangle.

SACRAMENTO-SAN JOAQUIN WATER SUPERVISION

The field work of the office is progressing satisfactorily and all points of diversion are being visited and the discharges of the various pumping plants measured. The irrigation of sugar beets is about completed and in some places the harvest of the crop has begun. During the coming month the Sacramento River will reach its low point for the summer and by this time next month should start to rise.

The stream flow into the delta shows a marked decrease from last month but is still above normal. The flow of the Sacramento River at Sacramento on July 23d was about 9100 cubic feet per second; on the same day the flow of the San Joaquin River at Lathrop was about 10,500 cubic feet per second. On the corresponding date last year, the flows were 3400 and 1650 cubic feet per second respectively.

CENTRAL VALLEY PROJECT

Working under a cooperative agreement with the U. S. Bureau of Reclamation, the Division of Water Resources, representing the Water Project Authority of the State of California, has continued engineering studies in connection with the Central Valley Project. The work has comprised the obtaining of data in the field and its analysis for use in connection with negotiations for the acquisition of water rights of lands bordering the San Joaquin River which are now being served by that stream. The field work has included topographic, hydrologic, geologic and soil surveys which were used in making studies and preparing reports and maps on land and water conditions. Studies have been continued of matters affecting the disposal of water made available by the project, including analyses of present ground water conditions and the requirements of certain areas for additional supplies.

Negotiations have been continued with public utility companies for the relocations of their facilities affected by the construction of certain units of the project.

FLOOD CONTROL AND RECLAMATION

The construction of a bridge across the borrow pit of the west levee of the Sutter By-pass at Sacramento Slough was completed. This bridge is approximately 175 feet long, the deck at ground level.

Work has continued in repairing flood damage in Glenn, Shasta, Butte and Tehama counties. The work of repairing 16 breaks on the Cherokee Canal in Reclamation District No. 833 has been completed, as has also the work on the northern bank of Honcut Creek.

Money has been allocated by the Reclamation Board for the construction of a county bridge across the borrow pit of the Dry Creek lateral of the Bear River levee system at a cost of $8,200.

Youth—Now on this ring I should like you to engrave: "For my darling Muriel."

Jeweler—Would it not be better to have simply: "For my darling?" You see, sir, it will be at least a week before we can let you have the ring.

Highway Bids and Awards for the Month of July, 1938

AMADOR COUNTY—Between 0.3 mile east of Plymouth and Fiddletown, about 5.5 miles liquid asphalt to be furnished and applied. District X, Feeder Road. Stewart M. McGaw, Stockton, $4,104; Chas. Kuppinger, Lakeport, $4,566; C. F. Fredericksen & Sons, Lower Lake, $3,805; Sheldon Oil Co., Suisun, $3,432; Hayward Building Material Co., Hayward, $3,576; Lee J. Immel, Berkeley $3,666; Garcia Construction Co., Irvington, $3,536; Acme Transportation, Inc., Oakland, $3,859; Oilfields Trucking Co., Bakersfield, $3,995; Powers & Patterson, Lower Lake, $3,726; A. A. Tieslau, Berkeley, $3,598; J. B. Breen, Sacramento, $3,421; Edward A. Forde, San Anselmo, $3,808. Contract awarded to Pacific Truck Service, Inc., San Jose, $3,206.88.

BUTTE COUNTY—Between six miles south and one mile south of Paradise, about 4.6 miles, a graded roadbed to be constructed. District III, Feeder Road. Claude C. Wood, Stockton, $44,610; M. J. Ruddy, Modesto, $45,771; George K. Thompson and Co., Los Angeles, $49,061; Hemstreet and Bell, Marysville, $50,865; Johnston Rock Co., Inc., Stockton, $62,635; Ralph A. Bell, Monrovia, $79,955. Contract awarded to Fredericksen & Westbrook, Lower Lake, $43,570.

CALAVERAS COUNTY—Between South Ford of Mokelumne River and Herberts Ranch, about 1.8 miles to be surfaced with untreated crushed gravel or stone and road-mix surfacing. District X, Feeder road. Hayward Building Material Co., Hayward, $8,309; Piazza & Huntley, San Jose, $9,847; Acme Transportation, Inc., Oakland, $9,871. Contract awarded to Garcia Construction Co., Irvington, $6,623.50.

CONTRA COSTA COUNTY—Between Muir and Willow Pass, about 8 miles to be graded, soil cement base and crusher run base to be constructed and surfaced with plant-mixed surfacing and 3 reinforced concrete slab bridges to be constructed. District IV, Route 106. Section C. Granfield, Farrar and Carlin, San Francisco, $342,583; Fredericksen and Westbrook, Lower Lake, $335,469; Hanrahan Co., Redwood City, $348,348; N. M. Ball Sons, Berkeley, $371,006; Heafey-Moore Co. & Fredericksen & Watson Construction Co., Oakland, $369,197; George Pollock Co., Sacramento, $354,376; A. Teichert & Son, Inc., Sacramento, $468,582. Contract awarded to Macco Construction Co., Clearwater, $312,555.40.

FRESNO AND MADERA COUNTIES—A bridge across San Joaquin River about 4 miles northeast of Auberry, consisting of a through steel truss span with timber stringer approach spans with concrete decks. District VI, Feeder road. Robert McCarthy, San Francisco, $29,873; Albert H. Siemer & John Carcano, San Anselmo, $30,661; J. S. Metzger & Sons, Los Angeles, $31,798; Trewhitt-Shields & Fisher, Fresno, $33,589; The Robertson Co., Los Angeles, $36,454. Contract awarded to S. A. Cummings, San Diego, $29,379.90.

HUMBOLDT COUNTY—At Greenlaw Bluffs, about 0.25 mile to be graded and surfaced with plant-mixed surfacing and sacked concrete riprap to be placed. District I, Route 1, Section E. Claude C. Wood, Lodi, $57,330; N. M. Ball and E. E. Smith, Berkeley, $58,727; Lee J. Immel, Berkeley, $58,744; Mercer, Fraser Company, Eureka, $59,901; Hemstreet and Bell, Marysville, $61,012; Fred A. Maurer and Son, Eureka, $62,472; Ransome Company, Emeryville, $65,392; Guerin Bros., San Francisco, $77,391. Contract awarded to Harold Smith, St. Helena, $56,824.

INYO COUNTY—Between the west city limits and Main Street, Bishop, about 0.5 mile to be graded and surfaced with roadmix surfacing. District IX, Route 76, Section B. A. S. Vinnell Co., Alhambra, $9,818; E. S. and N. S. Johnson, Pasadena, $9,647; Rexroth and Rexroth, Bakersfield, $8,448. Contract awarded to Basich Bros., Torrance, $7,047.

INYO COUNTY—Near Camp Sabrina, about 0.8 mile to be graded and surfaced with imported surfacing material and penetration oil treatment applied thereto, and a steel beam and reinforced concrete deck bridge to be constructed. District IX, Route 76. Section B. A. S. Vinnell Co., Alhambra, $27,348; Basich Brothers, Torrance, $25,432. Contract awarded to E. S. and N. S. Johnson, Pasadena, $21,960.

KERN COUNTY—Across Calloway Canal, about 3 miles west of Bakersfield, a reinforced concrete slab bridge to be constructed. District VI, Route 58, Section L. Rexroth and Rexroth, Bakersfield, $7,473; J. S. Metzger & Son, Los Angeles, $10,336; Griffith Company, Los Angeles, $6,755; F. A. Greenough, Bakersfield, $7,203; Macco Construction Co., Clearwater, $6,776; Palo Alto Road Materials Co., Palo Alto, $8,411. Contract awarded to Franzini & Fredenburg, San Rafael, $6,486.50.

KERN COUNTY—Between one mile south and two miles south of Rosedale, about one mile to be graded and oiled and two bridges to be constructed. District VI, Feeder Road. Rexroth and Rexroth, Bakersfield, $11,997; John Jurkovich, Fresno, $11,989; F. A. Greenough, Bakersfield, $15,150; Griffith Co., Los Angeles, $12,192; E. G. Perham, Los Angeles, $12,033; Franzini & Fredenburg, San Rafael, $12,407. Contract awarded to J. E. Anderson & George France, Visalia, $11,107.24.

KINGS COUNTY—Between Armona and Hanford, 3.5 miles to be graded and paved with asphalt concrete. District VI, Route 10. Section C. Han. Piazza and Huntley, San Jose, $98,585; N. M. Ball Sons, Berkeley, $98,851; Griffith Company, Los Angeles, $106,707; Warren Southwest, Inc., Los Angeles, $117,219. Contract awarded to Union Paving Co., San Francisco, $97,681.05.

LOS ANGELES COUNTY—Between 190th Street and Lomita Boulevard, about 4.6 miles to be graded and surfaced with plant-mixed surfacing. District VII, Route 165, Section A, Los Angeles. Sully-Miller Contracting Co., Long Beach, $121,819; L. A. Paving Co., Los Angeles, $131,765; C. O. Sparks and Mundo Engineering Co., Los Angeles, $143,681; Claude Fisher Co., Ltd., Los Angeles, $129,196; George R. Curtis Paving Co., Los Angeles, $116,178; A. S. Vinnell Co., Alhambra, $114,980; Martin Bros., Trucking Co., Long Beach, $125,166; Oswald Bros., Los Angeles, $114,302; J. E. Haddock, Ltd., Pasadena, $127,951; Basich Bros., Torrance, $115,265; United Concrete Pipe Corp., Los Angeles, $116,758. Contract awarded to Griffith Co., Los Angeles, $108,389.55.

LOS ANGELES COUNTY—Between Fair Oaks Avenue in South Pasadena and Glenarm St. in Pasadena, about 0.8 mile to be graded and paved with Portland cement concrete, asphalt concrete, and plant-mixed surfacing. District VII, Route 205, South Pasadena, Pasadena. Claude Fisher Co., Ltd., Los Angeles, $126,768; C. O. Sparks & Mundo Engineering Co., Los Angeles, $127,648; George R. Curtis Paving Co., Los Angeles, $115,734; Griffith Co., Los Angeles, $126,592; W. E. Hall Co., Alhambra, $145,779; Basich Bros., Torrance, $109,091. Contract awarded to J. E. Haddock, Ltd., Pasadena, $107,378.00.

LOS ANGELES COUNTY—Between Pasadena Avenue and Avenue 22, about 0.9 mile to be graded and paved with asphalt concrete, Portland cement concrete and plant-mixed surfacing. District VII, Route 165, Section L. A. Warren Southwest, Inc., Los Angeles, $98,697; George J. Bock Co., Los Angeles, $115,966; Radich and Brown, Los Angeles, $96,479; Griffith Company, Los Angeles, $113,973; Vido Kovacevich, South Gate, $101,476; George R. Curtis Paving Co., Los Angeles, $99,627; J. E. Haddock, Ltd., Pasadena, $141,808. Contract awarded to Bebek & Brkich, Los Angeles, $94,651.00.

LOS ANGELES COUNTY—A bridge across Malibu Creek, about 10 miles northwest of Santa Monica to be repaired. District VII, Route 60, Section A. Paul D. Lawrence Co., Los Angeles, $29,882; Byerts & Dunn, Los Angeles, $32,516; R. R. Bishop, Long Beach, $29,358; Carlo Bongiovanni, Beverly Hills, $31,963; The Contracting Engineers Co., Los Angeles, $29,211. Contract awarded to J. S. Metzger & Son, Los Angeles, $26,245.00.

LOS ANGELES COUNTY—A reinforced concrete girder bridge across Santa Clara River, about 5 miles east of Saugus, consisting of eight 50-foot spans, and two 12-foot 3-inch spans on reinforced concrete piers and abutments. District VII, Route 23, Section I. Dimmitt & Taylor, Los Angeles, $77,258; R. H. Travers, Los Angeles, $85,903; Gibbons & Reed Co., Burbank, $80,909; Byerts and Dunn, Los Angeles, $75,500; R. R. Bishop, Long Beach, $76,195; Bennett & Taylor, Los Angeles, $88,990; John Strona, Pomona, $77,000; C. O. Sparks & Mundo Engineering Co., Los Angeles, $78,927; Carlo Bongiovonni, Beverly Hills, $73,534; J. E. Haddock, Ltd., Pasadena, $74,330; Oscar Oberg, Los Angeles, $80,589; The Contracting Engineers Co., Los Angeles, $73,835; J. S. Metzger & Son, Los Angeles, $76,343, L. W. Odell & Geo. J. Bock Co., Los Angeles, $90,839. Contract awarded to Griffith Co., Los Angeles, $67,191.

LOS ANGELES COUNTY—Over Arroyo Seco Parkway at Avenue 60, three 40-foot reinforced concrete slab spans, on concrete piers and abutment to be constructed as an extension to an existing bridge and the northerly approach thereto and roadway on extension surfaced with asphalt concrete. District VII, Route 205, Section L. A. Byerts & Dunn, Los Angeles, $59,528; L. W. Odell & G. J. Bock Co., Los Angeles, $65,110; Dimmitt & Taylor, Los Angeles, $65,770; Fred E. Potts Co., Los Angeles, $64,446; John Strona, Pomona, $64,952; J. E. Haddock, Ltd., Pasadena, $61,798; Carlo Bongiovanni, Los Angeles, $62,114. Contract awarded to The Contracting Engineers Co., Los Angeles, $57,436.

MENDOCINO COUNTY—Between southerly boundary and Hopland, about 7 miles to be surfaced with plant-mixed surfacing. District I, Route 1, Section L. Piazza and Huntley, San Jose, $94,550; Mountain Construction Co., Sacramento, $102,037; Hemstreet and Bell, Marysville, $99,107; J. A. Casson, Hayward, $105,881; Union Paving Co., San Francisco, $91,366; Pacific States Construction Co., San Francisco, $99,458; N. M. Ball Sons, Berkeley, $85,328; A. G. Raisch, San Francisco, $110,780. Contract

awarded to Haurahan Co., Redwood City, $84,900.50.

MENDOCINO AND LAKE COUNTIES—5.5 miles east of Route 1 and portions between 17 and 23 miles east of Lucerne, about 0.6 mile to be graded and surfaced with roadmix surfacing and sacked concrete riprap to be placed. District I, Route 15. Sections A, C. E. A. Forde, San Anselmo, $45,-882; Fred J. Maurer & Son, Eureka, $45,-981; Claude C. Wood, Lodi, $46,724; Pacific States Construction Co., San Francisco, $47,121; Hemstreet and Bell, Marysville, $48,095; N. M. Ball Sons, Berkeley, $54,-707. Contract awarded to Lee J. Immel, Berkeley, $44,301.65.

MERCED COUNTY—17 miles east of Los Banos, a reinforced concrete bridge across San Joaquin River to be constructed, an existing reinforced concrete bridge to be widened, and 0.5 mile of roadway approaches to be graded and surfaced with plant-mixed surfacing. District X, Route 32, Section C. Bates & Rogers Construction Corp., Oakland, $114,583; J. F. Knapp, Oakland, $102,488. Contract awarded to C. W. Calletti & Co., San Rafael, $93,900.50.

MODOC COUNTY—A reinforced concrete slab bridge across North Fork of Pit River in City of Alturas, consisting of 1-45 foot span and 2-15 foot cantilever spans on concrete piles. District II, Route 73, Alturas. Franzini and Fredenburg, San Rafael, $21,325; Clifford A. Dunn, Klamath Falls, Oregon, $23,112; Albert H. Siemer and John Carcano, San Anselmo, $23,749; Campbell Construction Co., Sacramento, $27,-541; A. Soda and Son, Oakland, $27,484; John Rocca, San Rafael, $30,380. Contract awarded to M. A. Jenkins, Sacramento, $20,665.00.

MONO COUNTY — Between Sonora Junction and Coleville, 3.5 miles to be graded and surfaced with road-mix surfacing and Class "A" seal coat applied. District IX, Route 23, Section K. Isbell Construction Co., Reno, $102,984; Basich Brothers, Torrance, $103,187; George K. Thompson & Co., Los Angeles, $134,382. Contract awarded to A. S. Vinnell Co., Alhambra, $75,764.50.

ORANGE COUNTY—Grading and paving with Portland cement concrete, about 0.4 mile between 0.4 mile and 0.8 mile east of Huntington Beach. District VII, Ronte 60, Section A. Sully Miller Contracting Co., Long Beach, $15,399; Dimmitt & Taylor, Los Angeles, $16,312; C. R. Butterfield Kennedy Co., San Pedro, $17,650; Claude Fisher Co., Los Angeles, $14,689; Vido Kovacevich, South Gate, $13,699; J. E. Haddock, Ltd., Pasadena, $13,460. Contract awarded to Griffith Co., Los Angeles, $12,-682.90.

ORANGE COUNTY—A reinforced concrete girder bridge across Santiago Creek, ¼ mile south of Orange, consisting of one 92-foot span and two 49-foot spans on concrete piers and abutments. District VII, Route 18I, Section A. Macco Construction Co., Clearwater, $50,677; L. W. Odell & George J. Bock Co., Los Angeles, $53,285; C. O. Sparks and Mundo Engineering Co., Los Angeles, $67,130; Dnff and Vandenhoogen Co., Long Beach, $61,626; Oscar Oberg, Los Angeles, $58,957; Gibbons and Reed Co., Burbank, $53,951; R. R. Bishop, Long Beach, $54,622; Claude Fisher Co., Ltd., Los Angeles, $60,337; John Strona, Pomona, $51,868; J. E. Haddock, Ltd., Pasadena, $51,236; The Contracting Engineers Co., Los Angeles, $46,594. Contract awarded to Byerts & Dunn, Los Angeles, $45,723.

RIVERSIDE COUNTY—Reinforced concrete pedestrian underpass, 46th Avenue at Smurr Street, City of Indio. District XI, Route 64. Paul D. Lawrence Co., Los Angeles, $6,947; M. H. Golden, San Diego, $4,366; George Herz and Co., San Bernardino, $4,496. Contract awarded to V. R. Dennis Construction Co., San Diego, $4,295.25.

SAN BERNARDINO COUNTY—A reinforced concrete slab bridge across Cucamonga Wash, 2 miles east of Ontario, consisting of five 22-foot spans, two 20-foot spans, and two 5-foot 6-inch cantilever spans on concrete pile bents. District VIII, Route 19, Section B. Paul D. Lawrence Co., Los Angeles, $16,934; C. T. & W. P. Stover, Claremont, $17,802; Dimmitt & Taylor, Los Angeles, $19,451; Claude Fisher Co., Ltd., Los Angeles, $18,797; Gibbons & Reed Co., Burbank, $19,903; Byerts & Dunn, Los Angeles, $17,132; A. L. Gabrielson, Arlington, $16,406; Carlo Bongiovanni, Beverly Hills, $19,105; Bennett & Taylor, Los Angeles, $25,562; John Strona, Pomona, $19,-181; L. W. Odell & Geo. J. Bock Co., Los Angeles, $20,945; The Contracting Engineers Co., Los Angeles, $19,846; J. S. Metzger & Son, Los Angeles, $17,275. Contract awarded to Oberg Bros., Los Angeles, $15,736.00.

SAN FRANCISCO COUNTY—Reinforced concrete pedestrian subway extension. District IV, Route 55, Section S. F. Chas. L. Harney, San Francisco, $8,973; L. C. Seidel, Oakland, $8,872; R. G. Clifford, San Francisco, $10,365; A. G. Raisch, San Francisco, $10,438. Contract awarded to Palo Alto Road Materials, Palo Alto, $8,725.25.

SAN MATEO COUNTY—A reinforced concrete bridge across Coloma Creek in the City of South San Francisco, consisting of one 24-foot span and two 19-foot 6 inch spans and about 0.06 mile of roadway to be graded and surfaced with plant-mixed surfacing and a penetration oil treatment applied to shoulders. District IV, Route 6S, South San Francisco. Palo Alto Road Materials Co., Palo Alto, $20,343; M. B. McGowan, Inc., San Francisco, $24,263; Albert E. Mangs & Associates, San Francisco, $25,669; Healy Tibbitts Construction Co., San Francisco, $26,861; John Rocca, San Rafael, $27,989. Contract awarded to Franzini & Fredenburg, San Rafael, $19,646.35.

SAN MATEO COUNTY—Between Skyline Boulevard and La Honda, 1.3 miles to be graded. District IV, Feeder Road. M. J. Ruddy, Modesto, $54,215; X. Carrithers, San Mateo, $40,235; Macco Construction Co., Clearwater, $34,664; Piombo Bros. & Co., San Francisco, $45,056; Chas. L. Harney, San Francisco, $58,102; Geo. K. Thompson and Company, Los Angeles, $53,605; Hemstreet and Bell, Marysville, $47,210; Mountain Construction Co., Sacramento, $47,455; Granfield, Farrar and Carlin, San Francisco, $41,290; Guerin Bros., San Francisco, $44,559; Eaton and Smith, San Francisco, $90,290. Contract awarded to N. M. Ball Sons, Berkeley, $34,212.

SANTA BARBARA COUNTY—Between Guadalupe and Santa Maria, about 6.9 miles to be graded and surfaced with plant-mixed surfacing. District V, Route 14S, Section A. J. E. Haddock, Ltd., Pasadena, $142,813; Oswald Bros., Los Angeles, $155,625; Granite Construction Co., Ltd., Watsonville, $162,774; Griffith Company, Los Angeles, $163,237; Hanrahan Co., Redwood City, $173,206. Contract awarded to Basich Brothers, Torrance, $140,428.30.

SANTA BARBARA COUNTY—One mile east of Lompoc, a bridge across Santa Ynez River to be constructed and 0.8 mile of roadway to be graded and road-mix surface treatment applied. District V, Route 14S, Section B. Bennett & Taylor, Los Angeles, $95,666; Byerts & Dunn, Los Angeles, $98,-366; Macco Construction Co., Clearwater, $98,804; R. R. Bishop, Long Beach, $99,-920; J. E. Haddock, Ltd., Pasadena, $102,-036; Gibbons & Reed Co., Burbank, $107,621. Contract awarded to L. W. Odell and George J. Bock Co., Los Angeles, $91,010.05.

SHASTA, LASSEN, MODOC COUNTIES—Between Route 3 and Rush Creek, about 33.4 miles, seal coat to be applied at various locations. District II, Route 2S. Hayward Building Material Co., Hayward, $12,576; E. A. Forde, San Anselmo, $14,-046; Lee J. Immel, Berkeley, $14,970; Acme Transportation, Inc., Oakland, $15,716; C. F. Fredericksen & Sons, Lower Lake, $15,-536. Contract awarded to Pacific Truck Service, Inc., San Jose, $11,606.40.

SONOMA COUNTY—Between 1.5 mile southeast of Sebastopol and 3.9 miles southeast of Sabastopol, about 2.4 miles to be graded and surfaced with plant-mixed surfacing. District IV, Route 104, Section C. Lee J. Immel, Berkeley, $56,725; Hanrahan Co., Redwood City, $56,900; E. A. Forde, San Anselmo, $60,836; Union Paving Co., San Francisco, $62,258; Pacific States Construction Co., San Francisco, $62,292; Claude C. Wood, Lodi, $63,754; Harold Smith, St. Helena, $65,337; Chas. L. Harney, San Francisco, $72,480; A. Soda and Son, Oakland, $75,184; Contract awarded to Embleton-Schumacher Co., Albany, $54,151.91.

SUTTER COUNTY—Between 6.7 and 5.5 miles west of Yuba City about 1.2 miles crusher run base and plant-mixed surfacing borders to be placed. District III, Route 15, Section B. Piazza and Huntley, San Jose, $7,124. Contract awarded to Hemstreet and Bell, Marysville, $6,110.50.

VENTURA COUNTY—Between Fillmore and Hopper Creek, 4 miles to be graded and surfaced with asphalt concrete. District VII, Route 79, Section C. A. S. Vinnell Co., Alhambra, $162,893; Griffith Co., Los Angeles, $143,090. Contract awarded to Macco Construction Co., Clearwater, $129,-381.

YOLO COUNTY—A reinforced concrete bridge across Cache Creek about 3½ miles northwest of Rumsey to be constructed and about 0.5 mile of approaches to be graded and road-mix surface treatment applied. District III, Route 50, Section A. Campbell Construction Co., Sacramento, $73,332; C. W. Caletti & Co., San Rafael, $74,130; Robert McCarthy, San Francisco, $84,620; Holdener Construction Co., Sacramento, $95,429. Contract awarded to Hemstreet and Bell, Marysville, $68,225.25.

Behind Great Boulder Dam

Storage in Lake Mead behind Boulder dam has reached 20,000,000 acre feet, enough to provide 51,100 gallons of water for every man, woman and child in the United States, approximately the average per capita used in a year for domestic purposes. The maximum water elevation is 60 ft. below the crest of the spillways. However 7,189,000 acre feet additional will be required to cause the lake to spill.

A woman traveling by train was talking with the man in the next seat. In describing her holiday, she said that she had visited San Jose.

"You pronounce that wrong," said the man. "It is San Hosay. In California you should pronounce all J's as H's. When were you there?"

The woman thought a minute, then answered, "In Hune and Huly."

STATE OF CALIFORNIA

Department of Public Works

Headquarters: Public Works Building, Twelfth and N Streets, Sacramento

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HARRY A. HOPKINS.....Assistant Director

EARL LEE KELLY.....Director
EDWARD J. NERON.....Deputy Director

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G. T. McCOY, Assistant State Highway Engineer
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FRED J. GRUMM, Engineer of Surveys and Plans
R. M. GILLIS, Construction Engineer
T. H. DENNIS, Maintenance Engineer
F. W. PANHORST, Bridge Engineer
L. V. CAMPBELL, Engineer of City and Cooperative Projects
R. H. STALNAKER, Equipment Engineer
J. W. VICKREY, Safety Engineer
E. R. HIGGINS, Comptroller

DISTRICT ENGINEERS

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F. W. HASELWOOD, District II, Redding
CHARLES H. WHITMORE, District III, Marysville
JNO. H. SKEGGS, District IV, San Francisco
L. H. GIBSON, District V, San Luis Obispo
E. T. SCOTT (Acting), District VI, Fresno
S. V. CORTELYOU, District VII, Los Angeles
E. Q. SULLIVAN, District VIII, San Bernardino
S. W. LOWDEN (Acting), District IX, Bishop
R. E. PIERCE, District X, Stockton
E. E. WALLACE, District XI, San Diego

SAN FRANCISCO-OAKLAND BAY BRIDGE

C. E. ANDREW, Bridge Engineer

DIVISION OF WATER RESOURCES

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A. D. EDMONSTON, Deputy in Charge Water Resources Investigation
R. L. JONES, Deputy in Charge Flood Control and Reclamation
GEORGE W. HAWLEY, Deputy in Charge Dams
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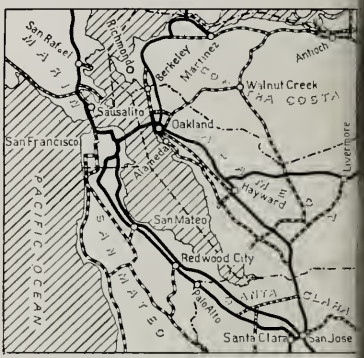
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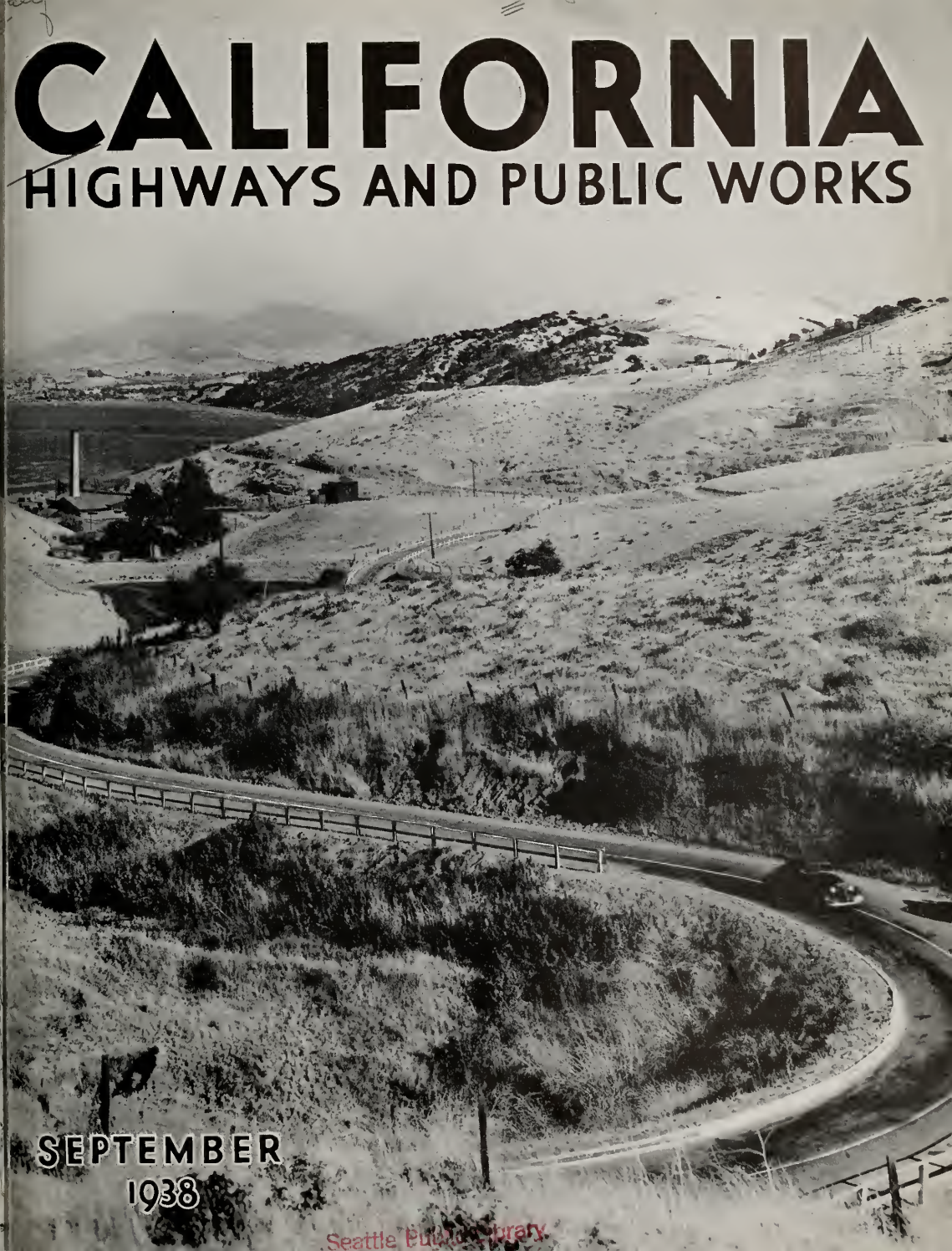
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CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways of the Department of Public Works, State of California

EARL LEE KELLY, Director C. H. PURCELL, State Highway Engineer JOHN W. HOWE, Editor K. C. ADAMS, Associate Editor

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To Bring Highways and Bridges in District IV to Adequate Standards Would Require Sum of $67,409,200

By JNO. H. SKEGGS, District Engineer

Modernizing Roads Costly

NINE counties, namely, Alameda, Contra Costa, Napa, Marin, San Francisco, San Mateo, Sonoma, Santa Clara and Santa Cruz constitute District IV of the State Division of Highways, with headquarters at San Francisco, and are so located as to practically surround the San Francisco and San Pablo Bays. In this area of 6,592 square miles, which is 4.2 per cent of the entire area of the State, reside 1,677,251 persons or 27.7 per cent of the State's total population, according to the 1930 U. S. Census.

The motor vehicle registration in the district for 1937 was 528,243 automobiles and 39,191 trucks or 22.8 per cent and 23.9 per cent, respectively, of the State's total registration during that period.

The State highway mileage outside of incorporated areas is 1094 and inside of incorporated municipalities 186, or a total of 1280 miles within the district, which, in the main, is metropolitan. Notwithstanding this aspect there are numerous mountain ranges and long stretches of deep marsh areas bordering our bays and ocean which present varied and perplexing engineering problems as difficult to solve and probably more expensive than any other section within the entire State.

The acquisition of rights of way upon which to build and expand require an endless amount of work, patience and expense. On account of the growing population and expensive property improvements our land acquisition expense (including that financed from the ½ cent gas tax to cities) approximates $9,706,855 for the present biennial period ending June 30, 1939.

Of this sum $1,326,170 has been expended to date. Money spent for this purpose never provides a single foot of highway grading or pavement. The preparation and handling of right of way matters require a highly trained and skillful personnel, including capable attorneys whose duties are the passing on all legal papers, preparation and trial in court of condemnation cases and numerous additional unclassified legal services.

The highway mileage within the district, totaling 1280 miles is classified as follows:

11 miles, or 1%, unimproved and unoiled earth roads.

135 miles, or 11%, oiled earth, inferior as to grade, alignment, width, drainage structures and carrying capacity.

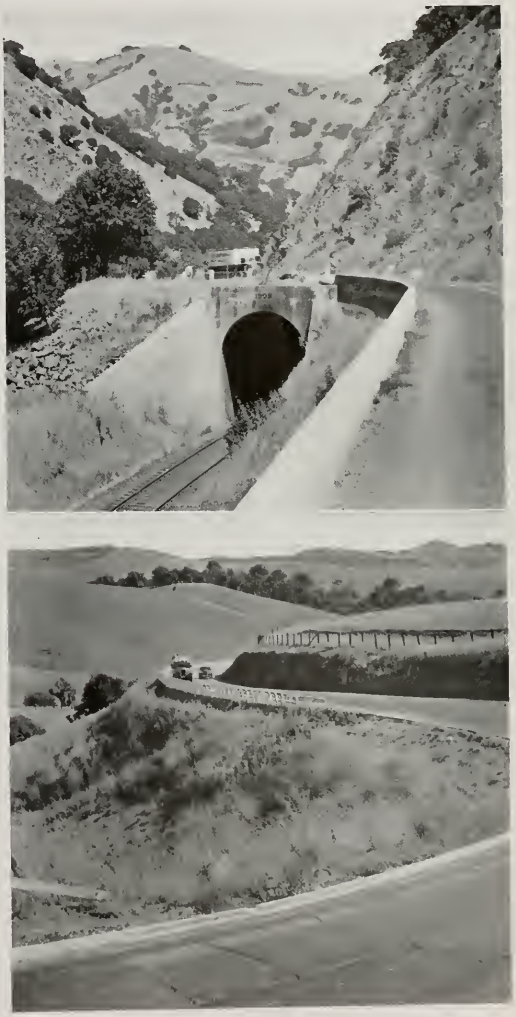
295 miles, or 23%, graveled roads with light oil surfaces, expensive to maintain.

207 miles, or 16%, intermediate improved types of surfacing.

625 miles, or 49% high types of pavement.

Of the high types of pavement 153 miles are within municipal areas. There are 7 miles of highway bridges, exclusive of the two major structures across San Francisco Bay. Fifty per cent of the district mileage should be widened or rebuilt or both, and new bridges built in place or on realignment.

(Continued on next page)



Narrow roadway with blind curves over railroad tunnel in Niles Canyon between Niles and Sunol. (Below) Circuitous routing with blind curves on Franklin Canyon Road.







Top—Skyline Boulevard route near Woodwardia in Santa Cruz County. Original narrow county road maintained by State. Center—Blind intersection with Southern Pacific grade crossing with blind approach to Western Pacific underpass in background, near Sunol, Alameda County. Bottom—Blind curves on Russian River highway, between Gurneville and Monte Rio, Sonoma County.

Multiple lane highways are distributed as follows:

Rural	In Municipalities
3-lanes, 85 miles	3-lanes, 9 miles
4-lanes, 55 miles	4-lanes, 52 miles
	6-lanes, 2 miles

Divided Highways

4-lanes, 17 miles	4-lanes, 7 miles
	6-lanes, 3 miles

The majority of the trunk line highways serving the metropolitan bay area are of stage construction design or being so planned as to insure sufficient and permanent right of way to adequately provide relief on highways now taxed to capacity and with hopes of providing needed room for expansion in the future.

Much has been written, great effort put forward and large expenditures made toward the elimination of highway and railroad grade crossings and there yet remains much to accomplish in this direction. However, there is so much greater loss of life and property damage due to highways crossing each other at grade as to justify, at least, attention comparable to that being given to protection at railroad crossings.

In this district there are about forty highway grade crossings where separations should be considered at this time, the average cost of each will be about $175,000. Several have been developed to the preliminary plan stage—None is estimated to cost approximately $175,000; another approximately $300,000.

Financing grade separations of this character will be a serious problem.

There are twenty-four bridges on the State highways, outside of municipalities, that are posted for restricted loadings and many other bridges, due to old age and fatigue, will shortly require the same treatment. The majority of these bridges are structures on county roads that came into the State highway system within the last six years at the time some 6,600 miles of road were turned over to the Divi-



Top—Narrow underpass with impaired clearance and inadequate sight distance beneath Western Pacific railroad near Sunol on State Route 107, Alameda County. Center—Railroad grade crossing of State Highway on "S" curve near Sunol station. Bottom—Narrow wooden bridge on Coast Highway, State Route 56, in Sonoma County, two miles northwest of Jenner.

sion of Highways through legislative action.

Due to the extremely heavy traffic within and adjacent to the large cities in the district we find it imperative that provisions be made for expanding the trunk line highways from two- and three-lane highways to four lanes divided, and several from four- to six-lane divided highways with provisions for local service roads on each side of and divided therefrom. This latter type of road, where in use, has proven a tremendous factor for safety and reduction of traffic congestion. Grade separations on these major traffic arteries are a necessity, but may be provided gradually.

The maintenance of the district mileage is much more expensive than would be the case were sufficient funds available for the construction or improvement of roads upon which no State construction funds have been spent. Reconstruction of roads and bridges that are inadequate in alignment, grade, width and carrying capacity and the widening of roads that are in good condition, but have insufficient carrying capacity, would also help to reduce maintenance expense.

The average maintenance cost during the past five years amounts to approximately $1,200,000 annually. Almost one-half of this sum of money could be saved each year if the highways serving the district could be immediately improved to the standard required to adequately meet traffic needs.

An old traffic count taken for one day at the northerly city line in Santa Cruz in 1916 showed 618 automobiles, 32 motorcycles and 29 buggies. Construction cost for this road amounted to $24,800 per mile for grading and paving. As compared with this, a portion of the same route now under reconstruction will cost in excess of $161,000 per mile. However, the present traffic count for one day, at Santa Cruz City line is 12,193 vehicles, the maximum hourly traffic count being 1,306 vehicles.

(Continued on page 28)



View of new Altamont Pass realignment, a modern four-lane divided highway. Note extensive parking area in right background.



Wide parking areas are provided on the realigned Altamont Pass Highway. Heavy rock cut on right is nearly 100 feet high.

Altamont Realignment Opened

"Dedicated to the public that built it, to those who participated in its construction, and to all who will travel over it—may they move speedily and safely, with the greatest happiness and satisfaction."

UTTERING these words of benediction as he pressed a white-hot branding iron against a rawhide riata held across the highway by two Livermore cowgirls, Governor Frank F. Merriam on August 4th burned away the symbolic barrier and officially opened to traffic the Altamont Pass realignment, locally known as Livermore Boulevard. This highly improved sector eliminates eight and a half miles of the old route with its narrow winding grades that long constituted a traffic bottleneck on State Highway No. 5 (U. S. 50), between Livermore and Tracy in Alameda County.

In this dedication address and in two separate celebration talks preceding the ceremony, Governor Merriam stressed the safety factors of the new four-lane divided highway and made an earnest plea for careful driving.

"The wisdom of the engineers, the skill of workmen have given us one of the finest highways in the world complete with every safety feature, but there is one factor they can not supply," he said. "That is the reasonable regard for safety which must be given by every motorist on the highway."

AGAINST TAX RAISES

Referring to the gas tax funds which make possible the construction of such high type modern highways, Governor Merriam emphasized his stand against diversion of these funds for any other than highway and bridge construction purposes in these words:

"The highway question is a tremendous one. There exists a greater necessity for work in this field than ever before. Greatest care must be exercised in conserving funds for this sole purpose. It has been said that I am in favor of increasing the gasoline tax. I wish to state that I am absolutely opposed not only to raising that tax but any other tax as well."

Joseph R. Knowland, treasurer of the State Chamber of Commerce and publisher of the Oakland Tribune, was general chairman of the dedication ceremonies held at western end of the new highway near Livermore. In introducing Governor Merriam, H. R. Judah, chairman of the California Highway Commission, and other speakers, Mr. Knowland paid a tribute to State Highway Engineer C. H. Purcell, Col. Jno. Skeggs, District Engineer, and other official and civic leaders for their enthusiastic efforts and interest that resulted in a splendid highway achievement.

LONG-PLANNED IMPROVEMENT

Construction of the new highway unit on the main artery between the San Francisco Bay area and Stockton and the upper San Joaquin Valley is

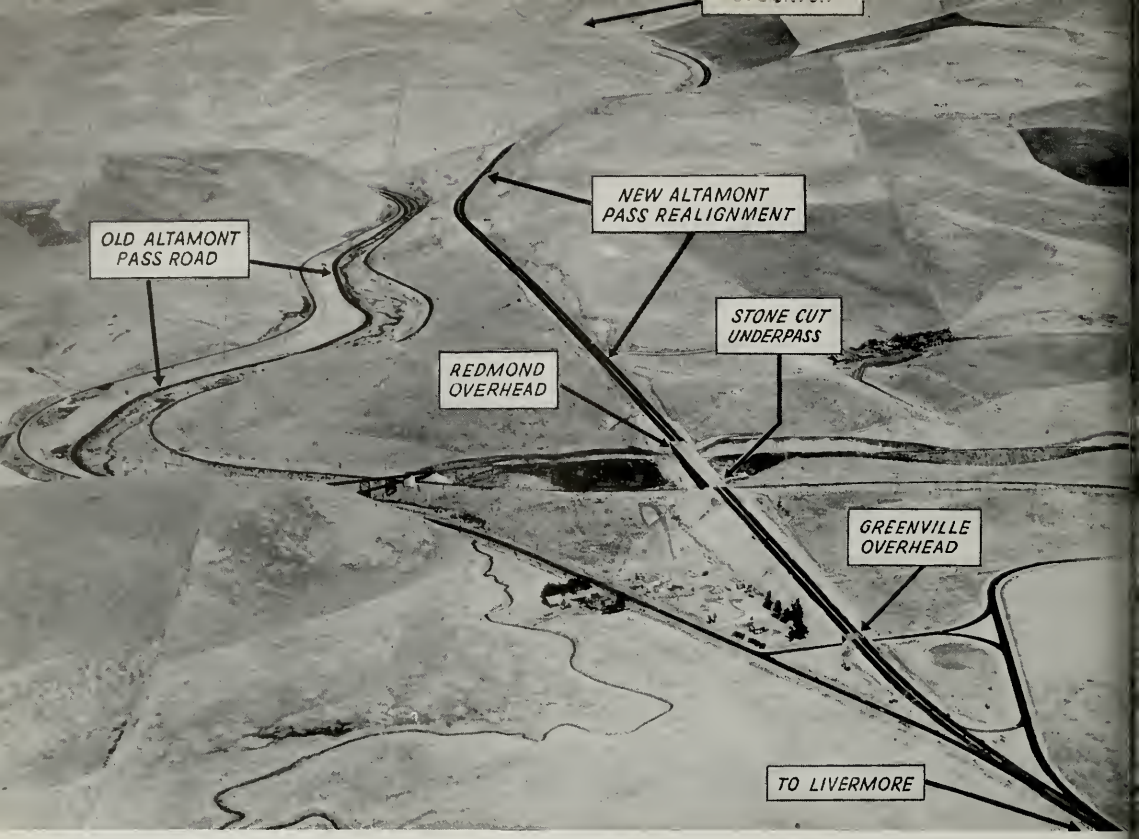


Photo courtesy of Metropolitan Oakland Area Commission

Aerial view of Altamont realignment showing direct route straight through the hills compared with circuitous course and many curves of old road.

the consummation of exhaustive study toward relief from the serious traffic congestion on this route which has been becoming more acute each year.

Traffic on this route between the valley and the East Bay section has shown unusual increases in the past ten years. In the summer of 1926 traffic counts indicated a travel of about 2600 vehicles daily and by the summer of 1936 the count had risen to nearly 9000 cars daily.

Of these 2600 vehicles in 1926, approximately 10 per cent were trucks and in 1936 this percentage had increased to 20 per cent, with heavy units predominating in the ratio of about two to one.

This heavy trucking, carrying the produce of the valley to the coast and hauling equipment and supplies to Stockton and other valley centers, has been largely responsible for the traffic congestion, as the long trucks with trailers or semitrailers moved slowly up the grades and around the curves on both sides of Altamont so that passing on the old two-lane road was at best hazardous and usually impossible. Most motorists who have traveled this highway in recent years have experienced the slow drag of traffic through the pass.

ENTIRELY NEW ROUTE

In comparison with the above cited traffic counts it is estimated that the new four-lane divided highway will comfortably carry from 2500 to 3000 vehicles per hour or 40,000 to 48,000 cars per 16-hour day.

The old route from Livermore easterly was so situated that it was impracticable for the Division of Highways to reconstruct the highway in short sections, as is the usual practice in the improvement of main highways, but necessitated relocation as an entirely new route over the 8¼ miles between Greenville and Mountain House at some distance to the south of the existing road with no opportunity for intermediate connections. It also was desirable to construct the new road as a single unit in order to keep the cost of the required expensive construction to a minimum.

As it was estimated that the total cost of the improvement would be over one million dollars, it was not possible to include so large a project in a single biennial budget until the current biennium.

It was at the August meeting of the California Highway Commission, held in Oakland in 1936, that this important project was definitely placed in the proposed budget for the biennium covering the period from July



Altamont Realignment features: Top—In foreground overhead structure over Southern Pacific Railroad. Large arched underpass in background carries Western Pacific tracks. Center—Greenville overhead crossing both railroads. Bottom—Close-up of new highway showing raised 4-foot division strip with 6-inch curb and signed opening.



With a white-hot branding iron Governor Frank F. Merriam burns the rawhide riata barrier held by two Livermore cowgirls and opens the highway.

1, 1937, to June 30, 1939. Immediately after this decision was made, final preliminary surveys for the relocation were begun and preparation of plans and estimates followed the field work rapidly so that the Division of Highways was in a position to advertise for bids on the work shortly after the budget was signed by Governor Merriam late in the spring of 1937.

The importance of this project in the work proposed by the Division of Highways for the current biennium was evidenced by the breaking of ground for construction just fifteen days after the beginning of the biennium.

The new location of the Altamont Pass highway provides a four-lane divided roadway constructed to the modern standards of alignment, grade and pavement, suitable for a main arterial. The prevailing grade is approximately 5 per cent with a maximum of 6 per cent. The new route is nearly one mile shorter than the old road between Greenville and Mountain House.

The number of curves has been reduced from 60 to 15; the total curvature from 1500 degrees to 427 degrees; and the minimum curve radius on the new permanent relocation is 2000 feet as against the short 250-foot radii existing on the old road.

The pavement cross-section calls for two 2-lane, asphalt plant-mixed rock pavements on crusher run base separated by a raised strip 4 feet wide. Portland cement concrete curbs 6 inches high have been placed along each side of the dividing strip.

The roadway excavation has involved the movement of over two million cubic yards of earth and rock and the overhaul on this material amounted to nearly thirty million station yards. Over ten million gallons of water were required for embankment compaction and other construction purposes and nearly 18,000 lineal feet of various sizes of corrugated metal pipe were needed for drainage purposes.

The cost of the road construction on this project has amounted to about $945,000.

The relocation of the route necessitated four grade separations, two with the tracks of the Southern Pacific Railroad and two with the Western Pacific Railway. To accomplish these separations three major structures have been built.

The largest is a reinforced concrete overhead which carries the highway over tracks of both railroads just easterly of Greenville. A second reinforced concrete overhead was constructed to carry the new road over the Southern Pacific at Redmond and an underpass consisting of an earth filled concrete arch was placed under the Western Pacific tracks at Stone Cut near Redmond.

Each of these three structures provides a 50-foot roadway with a 4-foot parting strip in the center to carry the divided traffic way plan throughout the length of the improvement. Adequate sidewalks are provided on the three grade separations.

Cost of the Greenville overhead amounts to about $125,000 and the separations at Redmond and Stone Cut, which were built under one contract, cost approximately $137,000.

The three contracts under which this relocation has been effected total $1,207,000.

The contractors for the grading and paving portion of the improvement were Granfield, Farrar and Carlin of San Francisco. The Greenville overhead was built by A. J. Raisch of San Jose, and the two structures near Redmond were constructed under a joint venture by Heafey-Moore and Fredrickson & Watson Construction Company and Fredrickson Brothers.

The extensive celebration program arranged by the State Chamber of Commerce with the cooperation of the Livermore, Tracy, and Stockton chambers and the Metropolitan Oakland Area Committee included a large civic banquet in Oakland on Wednesday evening, August 3, a breakfast at Liv-

(Continued on page 10)

Traffic on State Highways Shows 3.3 Per Cent Increase Over 1937

THE regular annual statewide traffic count taken on State highways Sunday and Monday, July 10 and 11, shows an increase of 3.3 per cent over the corresponding period in 1937.

Increases are shown by all of the various route groups for both Sunday and Monday, although the Sunday increases in all cases were smaller than those for Monday and were much less uniform.

The taking of the actual count followed the procedure of previous years and covered the 16-hour period from 6 a.m. to 10 p.m. for both Sunday and Monday. Traffic was segregated by hourly periods into the following classifications: California passenger cars, out-of-state passenger cars, buses, light trucks, heavy trucks, trailers drawn by trucks, trailer coaches, and other passenger-car trailers.

The comparisons for the various groupings are as follows:

PER CENT GAIN OR LOSS FOR 1938 COUNT AS COMPARED WITH 1937

	Sunday	Monday
All Routes	+1.26	+4.28
Main North and South Routes	+0.92	+4.45
Interstate Connections	+3.39	+5.59
Laterals Between Inland and Coast	+1.57	+3.65
Recreational Routes	+0.12	+3.13

The gain or loss of traffic volume for State Highway Routes 1 to 80, inclusive, which constitute the basis for the foregoing summary, is shown in the following tabulation:

Route	Termini	1938 Per cent gain or loss Sunday Gain	Sunday Loss	Monday Gain	Monday Loss
1.	Sausalito-Oregon Line		10.92		4.54
2.	Mexico Line-San Francisco	0.94		1.37	
3.	Sacramento-Oregon Line	5.19		10.17	
4.	Los Angeles-Sacramento	8.70		12.52	
5.	Santa Cruz-Jc. Rt. 65 near Mokelumne Hill	0.72			2.80
6.	Napa-Sacramento via Winters	15.86			4.92
7.	Crockett-Red Bluff	5.32		2.75	
8.	Ignacio-Cordelia via Napa	0.49		6.79	
9.	Rt. 2 near Montalvo-San Bernardino		1.18	2.48	
10.	Rt. 2 at San Lucas-Sequoia National Park	13.82		13.71	
11.	Rt. 75 near Antioch-Nevada Line via Placerville	4.56		6.12	
12.	San Diego-El Centro	8.97		8.93	
13.	Rt. 4 at Salida-Rt. 23 at Sonora Jc.	9.61			1.18
14.	Albany-Martinez		12.04		4.55
15.	Rt. 1 near Calpella-Rt. 37 near Cisco	2.23		18.12	
16.	Hopland-Lakeport	4.50		15.88	
17.	Rt. 3 at Roseville-Rt. 15, Nevada City		1.83	6.13	
18.	Rt. 4 at Merced-Rt. 40 near Sequoia		8.85		10.09
19.	Rt. 2 at Fullerton-Rt. 26 at Beaumont	6.86		6.43	
20.	Rt. 1 near Arcata-Rt. 83 at Park Boundary		3.04	18.85	
21.	Rt. 3 near Richvale-Rt. 29 near Chilcoot via Quincy	60.45		56.35	
22.	Rt. 56, Castroville-Rt. 29 via Hollister		4.69		5.79
24.	Rt. 4 near Lodi-Nevada State Line		2.24	5.88	
23.	Rt. 4 at Tunnel Sta.-Rt. 11, Alpine Jc.	11.01		6.38	
25.	Rt. 37 at Colfax-Rt. 83 near Sattley	8.32		26.88	
26.	Los Angeles-Mexico via San Bernardino	2.21		4.78	
27.	El Centro-Yuma		6.74	0.62	
28.	Redding-Nevada Line via Alturas		2.76	2.71	
29.	Peanut-Nevada Line near Purdy's	17.80			4.63
31.	Colton-Nevada State Line	16.90		13.44	
32.	Rt. 56, Watsonville-Rt. 4 near Califa		6.56	13.37	
33.	Rt. 56 near Cambria-Rt. 4 near Famosa	9.73		7.88	
34.	Rt. 4 at Galt-Rt. 23 at Pickett's Jc.	23.91		4.90	
35.	Rt. 1 at Alton-Rt. 20 at Douglas City	8.77		14.27	
37.	Auburn-Truckee		6.65	4.34	
38.	Rt. 11 at Mays-Nevada Line via Truckee River		11.40	6.00	
39.	Rt. 38 at Tahoe City-Nevada State Line	6.07		16.56	
40.	Rt. 13 near Montezuma-Rt. 76 at Benton		28.40		15.67
41.	Rt. 5 near Tracy-Kings River Canyon via Fresno		11.01		4.24
42.	Redwood Park-Los Gatos	5.62			0.42
43.	Rt. 60 at Newport Beach-Rt. 31 near Victorville	3.73		8.47	
44.	Boulder Creek-Redwood Park	0.96		16.69	
45.	Rt. 7, Willows-Rt. 3 near Biggs		2.62		13.06
46.	Rt. 1 near Klamath-Rt. 3 near Cray	16.68		34.73	
47.	Rt. 7, Orland-Rt. 29 near Morgan		11.94		2.03
48.	Rt. 1 N. of Cloverdale-Rt. 56 near Albion		15.92	3.88	
49.	Napa-Rt. 15 near Sweet Hollow Summit		8.18		8.24
50.	Sacramento-Rt. 15 near Wilbur Springs	0.42			3.56
51.	Rt. 8 at Schellville-Sebastopol	0.32		0.96	
52.	Alta-Tiburon	2.56		12.85	
53.	Rt. 7 at Fairfield-Rt. 4 at Lodi via Rio Vista	17.00		9.50	
54.	Rt. 11 at Perkins-Rt. 65 at Central House	17.50		15.30	
55.	Rt. 5 near Glenwood-San Francisco		14.30	5.46	
56.	Rt. 2 at Las Cruces-Rt. 1 near Fernbridge		8.85		4.78
57.	Rt. 2 near Santa Maria-Rt. 23 near Freeman via Bakersfield	15.47		8.22	
58.	Rt. 2 near Santa Margarita-Arizona Line near Topac via Mojave and Barstow	13.08		8.75	
59.	Rt. 4 at Gorman-Rt. 43 at Lake Arrowhead		13.24	3.81	
60.	Rt. 2 at Serra-Rt. 2 at El Rio	1.94		2.04	
61.	Rt. 4 S. of Glendale-Rt. 59 near Phelan	10.35		12.41	
62.	Rt. 171 at Northam-Rt. 61 near Crystal Lake		17.95		21.94
63.	Big Pine-Nevada State Line	18.78		10.40	
64.	Rt. 2 at San Juan Capistrano-Blythe		3.47		1.22
65.	Rt. 18 near Mariposa-Auburn	8.18		11.08	
66.	Rt. 5 near Mossdale-Rt. 13 near Oakdale	8.88		4.49	
67.	Pajaro River-Rt. 2 near San Benito River Bridge		9.04	5.20	
68.	San Jose-San Francisco		13.92	2.82	
69.	Rt. 5 at Warm Springs-Rt. 1, San Rafael		4.41	19.01	
70.	Ukiah-Talmage	0.72			5.91
71.	Crescent City-Oregon Line		17.00		6.12
72.	Weed-Oregon Line	4.05			14.15
73.	Rt. 29 near Johnstonville-Oregon Line	9.25			4.40
74.	Napa Wye-Cordelia via Vallejo and Benicia	2.71		5.14	
75.	Oakland-Jc. 65 at Altaville	34.67		27.93	
76.	Rt. 125 at Shaw Ave.-Nevada State Line near Benton		5.82		1.32
77.	San Diego-Los Angeles via Pomona	13.32		8.65	
78.	Rt. 12 near Descanso-Rt. 19 near March Field	9.31		4.22	
79.	Rt. 2, Ventura-Rt. 4 at Castaic		17.86		3.01
80.	Rt. 51, Rincon Creek-Rt. 2 near Zaca	9.02		7.68	

Practice Traffic Safety

Practice Traffic Safety

Practice Traffic Safety

Altamont Realignment Opened

(Continued from page 8)

ermore preceding the dedication and a luncheon at Tracy following the colorful ceremonial.

In his address at the Oakland banquet Governor Merriam said:

"It is not possible at this time to even attempt an estimate of the benefits which will accrue to Oakland, the entire San Francisco Bay area and all of Central California as a result of elimination of the unsatisfactory highway conditions which have obtained for so many decades.

"This new and wonderful highway with slight grades and virtually no curves is fast. Persons and freight will be carried over and through the smoothly rolling hills at a rapid pace and there will be more safety. Ship freight will be transferred from your ships calling at the modern piers of Oakland and in an hour or two may be carried to the valley destinations in record time. It will help your shipping and your industries. Also it will help business in the interior and contribute tremendously to the development of more satisfactory friendly and cultural relations between the city and the country."

Irving H. Kahn, vice president of the Oakland Chamber of Commerce, the toastmaster, was presented by Victor J. La Motte, president of the organization.

Mayor William J. McCracken of Oakland, the first speaker, declared it has been the ambition of the Oakland business and shipping fraternity for many years to smash the old Altamont barrier; that satisfactory business associations between the Oakland area and Central California could never be achieved until this new highway was built.

AMONG THE SPEAKERS

Among the other speakers were: George F. Tubbs, mayor of Livermore; C. P. Button, chairman of the Oakland Chamber's highway committee; H. R. Judah, California State Highway Commissioner; Earl Lee Kelly, Director, State Department of Public Works; C. H. Purcell, State Highway Engineer; Dr. E. J. Leach, chairman, Committee Coast Highway Commission.

Others at the speakers' table included President William Larsen of the Tracy Chamber of Commerce; Mayor James Lamb of Tracy; C. C. Cottrell, representing the State Automobile Association and Automobile Club of Southern California; P. G. Jasper and William F. Hart, members of the State Highway Commission; Joseph R. Knowland; Carl Hoffman, publisher of the Post-Enquirer; Congressman Albert E. Carter; A. J. Lundberg, regional director California State Chamber of Commerce and president of the East Bay Transit System, and Harold D. Weber, general manager, Oakland Chamber of Commerce.

In his remarks Director Earl Lee Kelly stated that "the new Livermore Boulevard highway represented the largest excavation job ever let in one contract by the State and the completion of this section of the trunk highway leading from the East Bay into the San Joaquin Valley is probably second only to the San Francisco-Oakland Bay Bridge in importance to the development of the bay area. The steady increase in traffic on the route, which has been in progress over the past several years, will undoubtedly continue at an accelerated rate, and there is a marked feeling of satisfaction to the highway officials of California that in the development of the State Highway System, facilities providing for quicker and safer travel have been furnished to motorists who use this arterial."

Lantern Thieves Sentenced to Jail

Lives of motorists are occasionally endangered by the theft of red lanterns placed as warning signals at dangerous spots on the State highways. Such an incident occurred recently in the Merced district where Maintenance Superintendent Scott Sawyer reports the arrest of two culprits who were sentenced to thirty days in jail by Justice C. H. McCray.

The men who gave their names as Robert Burns and Harry Merchant, described as transients, stole a red lantern marking the edge of a flooded area of the pavement on the Merced-Los Banos Highway, six miles south of Merced. Local residents saw the theft and reported it to Highway Patrolman C. W. Farr, who made the arrests.

Superintendent Sawyer reports that as many as 25 red lanterns have been stolen in one night in his district.

New Bridge at Red Bluff is Dedicated

DEDICATION of the new seven-span steel and concrete bridge across the Sacramento River at Red Bluff August 6th was the high spot of a week-end celebration that included speed-boat races, a street dance, a minor league championship ball game and other special events and festivities that drew a crowd of over two thousand people.

The official bridge ceremonies began at 8 p.m. Saturday evening on the brilliantly illuminated new structure, when L. E. Bronson, secretary of the chamber of commerce, introduced Tom McGlynn as master of ceremonies, who in turn introduced the other speakers, including State Senator D. Jack Metzger and State Director of Public Works Earl Lee Kelly, representing Governor Merriam.

Paying a tribute to Senator Metzger's efforts at Sacramento in securing the new bridge, Mr. Kelly said the narrow old structure built by Tehama County in 1884 had stood for over half a century but the new one had been planned and built to stand for two hundred years.

At the conclusion of the speeches, Miss Red Bluff, in the charming person of Miss Phyllis Gadwood, clad in queenly attire and escorted by Mrs. Earl Lee Kelly and Senator Metzger, cut the ribbon barrier in a blaze of flashlights, officially opening the bridge to traffic.

Immediately after the official ceremonies Main street was given over to a free street dance and sports events continued the celebration program on Sunday.

The new bridge is of continuous steel girder construction, 820 feet long, with a 34-foot roadway and two 4-foot sidewalks. The structure consists of reinforced concrete piers with spread footings founded on steel H piles.

There are seven continuous, three-girder, steel deck spans. The center span is 126 feet long and is flanked on each side by three spans, one 143 feet, one 108 feet and one 96 feet in length.

Twelve lighting standards placed

This picture affords a striking comparison of the new, wide Red Bluff bridge with the narrow old structure at left.

at intervals along the steel handrail provide illumination at night. These lights are of the sodium vapor type.

J. F. Knapp of Oakland was the general contractor on the project. The furnishing and placing of structural steel was subcontracted to Moore Dry Dock Company. Approaches to the bridge were built under a separate contract which also included removal of the old bridge. This contract was handled by N. M. Ball and Sons.

Cost of the bridge construction was $250,000 and $40,000 for the approaches.

Maximum height of pier shaft is 61 feet, minimum height 35 feet. All girders are 9 feet in depth and range in weight from 11 to 20 tons each.

Due to sustained periods of high water it was necessary to construct the steel girders with a guy derrick from the top of the bridge. In spite of the additional hazards presented by this method, no serious injuries or fatalities resulted.

The contract was approved May 20, 1937, and all work was completed July 25, 1938.

The steel girders of this 820-foot bridge are 9 feet in depth. Reinforced concrete piers are founded on steel H piles.



Relation of Engineering to Accident Prevention

The following article is the second and final part of a paper on "The Relation of Scientific Engineering to Accident Prevention" prepared and presented by J. W. Vickrey, Safety Engineer of the Division of Highways, at the Institute of Government held at the University of Southern California in Los Angeles, July 14, 1938.

By J. W. VICKREY, Safety Engineer, Division of Highways

ENGINEERING with relation to accident prevention on our rural State highways is like all other accident prevention work, a matter for selective attack.

The vast majority of rural road mileage has been inherited. When these roads were built there was no thought of motor vehicle traffic and consequently no provision was made to satisfy the demands which an entirely new type of transportation was to bring.

The first motor vehicles were compelled to accommodate themselves, both as to design and operation, to the roads that existed. This situation has long since been reversed. It is now the task of the highway engineer to see that the highways fit the present type and mode of traffic, and where extensive construction or reconstruction is contemplated that provision also be made for such probable future traffic requirements as can be foreseen.

SALVAGING OLD ROADS

Our thousands of miles of inherited rural roads can not be scrapped just because of certain inadequacies in meeting all the demands of motor vehicle traffic. Quite frankly, the public can not afford it, particularly the motoring public on whom more and more the entire financial burden for roads is being placed. We can ill afford to waste the vast potential traffic value of these older roads by failing to provide those funds—modest when compared with the cost of a brand new model—which are required for fitting them to meet the reasonable demands of the traffic they may serve.

The vast majority of the mileage is for two-lane traffic only. There is little reason to believe that in percentage of total road mileage this situation will ever be greatly changed. The traffic which they now carry, or can be expected to carry in the predictable future, will not justify the cost for multiple-lane construction and all the other desirable safety features that can be incorporated into the design for that limited mileage of the road system where traffic volume does justify a super highway.

The engineer readily recognizes this and concentrates effort on those features that are economically feasible. There are two main avenues of approach: one to deal with features that have general application and may become parts of standard design policy; and the other, to deal with specific situations where the rate of accident occurrence is greater than the normal expectancy. Both are necessary in any complete program. Their value will depend upon the completeness and accuracy of the accident record and its correct analysis.

TWO ACCIDENT GROUPS

For purposes of review and analysis, traffic accidents fall naturally into two main groups: those involving only a single vehicle and those where two or more vehicles are involved. In the one the volume, density, and type of traffic need not be considered in connection with their study, while any study of accidents where two or more cars are involved that does not include consideration of the prevailing traffic, can have very little meaning. Pedestrian accidents demand separate and distinct treatment, inasmuch as another wholly different type of traffic is introduced.

Thorough analysis to determine the whole accident prevention program and proper relation between all parts of it, requires presentation of a number of broad combinations and their successive breakdowns by particular

Governor Merriam Welcomes Delegates to Safety Conclave

An inspiring message of greeting was given by Governor Frank F. Merriam to the delegates of the Fourth Annual Western Safety Conference being held in Los Angeles as this magazine is going to press. It reads as follows:

STATE OF CALIFORNIA
Governor's Office
Sacramento

GREETINGS

In welcoming the Delegates of the Western States Safety Conference to their Fourth Annual Meeting in the City of Los Angeles, September 12th to September 16th, 1938, I feel that the opportunity is freighted with a privilege and a duty. It is a privilege to welcome you who are vitally interested in campaigning to save human life. It is a duty of my office to solicit from you any suggestions which may be evolved in this Conference, for it is public interest such as yours which furnishes the inspiration and courage for constructive official action. Your membership is circumscribed by the boundaries of western geographical divisions, but your influence developed through this Conference can be and, I am sure, will be unbounded. I salute your efforts.

FRANK F. MERRIAM,
Governor of California.



Passenger car and truck crashed in the middle of the four-lane Bay Shore Highway near San Francisco. Three killed.

elements. No attempt will be made to go into these in detail. A single example of subdividing the two-or-more-car group of accidents will suffice to show how essential it is to make such breakdowns if we are to know with any degree of certainty not only what we should do to reduce accidents but where and how we should spend our time and money to accomplish the greatest results in the shortest space of time.

Two-car accidents are of three main types: "Approaching," where the vehicles involved are traveling in opposite directions on the same road; "Overtaking," where both are going in the same direction; and "Paths Intersecting," where the two are traveling different roads which intersect at grade. A minor subdivision of the last group covers those cases where the paths of movement of cars traveling on the same road intersect, as in making left or right or "U" turns not at road intersections.

PREVENTATIVE QUESTIONS

In what percentage of the total do these various types appear, in general or on particular stretches of road? Preventative measures are not the same for each type, nor do they call for the same expenditure.

Single-car accidents, to casual thought the simpler of the two main groups, are nevertheless rather more difficult to divide into distinct types. A natural division is between those resulting from obstructions—other than motor vehicles—on the traveled way and those in which the car left the traveled way.

Incidentally, it may be noted that aside from those cases where pedestrians are also involved, the vast majority of single-car accidents fall into that class reported as "drove off the road." In the absence of any evidence of specific defect in either machine or roadway, there arises the presumption that failure on the part of the driver was directly responsible. The engineer interested in accident prevention is not satisfied to accept such presumption as the complete answer until he has assured himself that no surface condition or element of geometric design of the roadway appreciably contributed toward the unsafe driving.

PEDESTRIAN PROBLEMS

The problem that is presented to the engineer by pedestrian accidents on our rural State highways is truly one of the most discouraging with which he has to deal—discouraging because there seems to be so little good reason why they should occur and because there is so little that he, as an engineer, can reasonably do to prevent them. I am speaking now of our own State. Pedestrian accidents represent less than 7 per cent of all accidents reported on the rural State highways. A much more serious aspect is presented when we note that if fatalities alone are considered, over 24 per cent are pedestrians.

To a much greater degree than the motorist, the pedestrian through his own individual actions and exercise of judgment has the power to escape accident. The situation is rare when he can not safely step off the traveled way to permit passage of a motor vehicle. Only impatience compels him to cross a highway in the face of traffic. The motor vehicle on a rural highway is always to be expected by the pedestrian, while the pedestrian on our rural roads is not the normal condition which the motorist may expect and thus presents an element of surprise.

It is true that a large percentage of pedestrian accidents occur during darkness. Undoubtedly it is more difficult for the motorist to discern a pedestrian at night than in daylight, but this is not true of the pedestrian's ability to see an approaching automobile. Every advantage rests with the pedestrian to avoid collision with a motor vehicle if he will simply exercise the care which is demanded by a situation which otherwise will almost certainly result in either death or serious injury to himself.

DIFFICULTIES ENCOUNTERED

Thirty per cent of the pedestrians killed on our rural State highways last year were either under the influence of liquor or had been drinking. It is difficult to envision any physical safeguard that would appreciably affect this type of accident. Of the remaining 70 per cent only two per cent were reported as having physical defects, such as defective

(Continued on page 18)

Uniform Code for Loads, Size, Wei

THE seventeenth annual convention of the Western Association of State Highway Officials was held at Reno August 10, 11 and 12, at which there were gathered 100 registered delegates representing the eleven Western States and Texas, as well as a large number of guests.

President Lacy V. Murrow, Director of Highways in the State of Washington, called the meeting to order at 9.30 on the morning of August 10th and the delegates were welcomed to Nevada by Mayor John Cooper of Reno, and Governor Richard Kirkman Sr. of Nevada.

Following a roll call, the meeting was addressed by Dr. L. I. Hewes, Deputy Chief Engineer of the Bureau of Public Roads, who reviewed the progress of highway work and outlined the work being accomplished by the Highway Planning Survey. He described its final value as a guide to the proper planning of highways and a means of indicating their future needs. He pointed out in his talk that the data already collected showed many interesting facts not commonly known among those interested in highway work.

The delegates then adjourned to attend the luncheon provided by Nevada at the Riverside Hotel. Here the delegates were addressed by C. H.





Proposed Standard Load Dimensions and Speeds for Motor Vehicles Spe

1. **WIDTH.** No vehicle shall exceed a total outside width, including any load thereon, of 8 feet, except vehicles now in operation which, by reason of the substitution of pneumatic tires for other types of tires, exceed the above limit, provided further that in no case shall such width exceed 102 inches and that after January 1, 1945, no such vehicle and/or loads exceeding 8 feet in width shall be operated.

2. **HEIGHT.** No vehicle unladen or with load shall exceed a height of 13 feet 6 inches, except that the public body having jurisdiction may at its discretion, reduce this height to heights consistent with the condition of individual sections of highway.

3. **LENGTH.** (a) No vehicle and load thereon shall exceed an overall length of 35 feet.

(b) Combinations of vehicles shall consist of not more than two units, and, shall not exceed a total length of 60 feet, but the public body having jurisdiction may, at its discretion, reduce this length.

4. **SPEED.** (a) No motor vehicle shall be unnecessarily driven at such a slow speed as to impede movement of traffic, except when reduced speed is necessary.

(b) **MAXIMUM SPEED.** No truck shall be operated at a speed greater than 45 miles per hour.

(c) Vehicles equipped with s
operated at a speed not in excess

5. **AXLE LOAD.** (a) The ve
at 10 miles per hour or less, shall

(b) No wheel equipped wit
excess of 9,000 pounds, nor shall
wheels equipped with pneumatic

No wheel equipped with so
load in excess of 8,000 pounds,
having wheels equipped with such

An axle load shall be the tot
included between two parallel tra

(c) The above limits are reco
roads, but should not be construe
politan areas if any state desires.

(d) These weight specificat
made more restrictive where tem

6. **GROSS WEIGHTS.** (a)
recommended axle loads, no ve
operated whose gross weight, wi

t, Recommended by W.A.S.H.O.





Purcell, State Highway Engineer of California and President of the American Association of State Highway Officials, on the subject of highway financing and the relation of highway building in the Western States to the general business conditions in the Eastern States.

After the luncheon the general meeting was addressed by E. P. Palmer, President Associated General Contractors of America on the subject of problems arising from labor organization in the highway field and by Roy McKaig of Idaho representing the Highway Users Conference on the subject: "Western Agriculture Needs Highway Transportation."

A separate meeting was held by the bridge committee of the W. A. S. H. O. in conjunction with a committee appointed to make a study of the question of permissible dimensions and loads for motor vehicles. This committee was appointed as a result of a resolution passed by the association at their meeting in Denver in July, 1937.

An open meeting was held which was attended by many representatives of bodies operating trucks on the highways and also by the traffic engineers of several of the States. Representatives of the trucking interests

(Continued on page 22)

l in Resolution Adopted by Western State Highway Officials Convention

ubber or cushion tires shall be
les per hour.

all vehicles, except those operated
ped with pneumatic tires.

natic tires shall carry a load in
l load carried by any axle having
ceed 18,000 pounds.

r, or cushion tires shall carry a
the total load carried by an axle
ceed 16,000 pounds.

n all wheels whose centers may be
lanes 40 inches apart.

d for all main rural and intercity
biting heavier axle loads in metro-

wheel and axle loads may be
oad conditions justify.

to the limitation imposed by the
combination of vehicles shall be
exceeds that given by the formula

$W = 750\ (L \neq 40)$ where
W = total gross weight, with load, in pounds;
L = the distance between the first and last axles of a vehicle or combination of vehicles in feet.

The same limitations shall be applied to any group of axles within the vehicle or combination of vehicles.

(b) Provided further that the total gross weight, with load, on any group of axles of a vehicle or combination of vehicles where the distance between the first and last axles of the group is 18 feet or less, shall not exceed that given by the formula

$W = 650\ (L \neq 40)$ where
W = total gross weight, with load, in pounds on the group of axles under consideration;
L = the distance between the first and last axles of the group under consideration.

7. **LOAD PER INCH OF TIRE WIDTH**: No wheel equipped with pneumatic, solid rubber, or cushion tires shall carry a load in excess of 600 pounds for each inch of tire width.

The width of pneumatic tires shall be taken as the manufacturers' rating. The width of solid rubber and cushion tires shall be measured at the flange of the rim.

Protecting Highway Roadsides From Business Encroachments

TWO of the photographs on the opposite page contrast conditions immediately after the construction in 1932 of a new State highway approach from the south to the city of Modesto, and the condition of the same highway today.

When this road was laid out, it ran through vineyards and other agricultural land. It was open, unrestricted highway to the city limits of Modesto. Today, for a long distance south of the bridge, it is a 20-mile zone. Its development as a business section, attached to but outside of the city limits of Modesto, is continuing.

The third photograph on the page shows a portion of the new Vacaville Cut-off. The old road through Vacaville was winding and for the most of its distance was within business or residence district zones. It brought all of the through traffic between San Francisco and Sacramento in conflict with the local traffic of the city. The new route is shorter, has no restricted speed zones, and is generally much safer.

ROADSIDE DEVELOPMENT CONTROL

The respective photographs are intended to focus attention upon the problem of protecting the borders of important highways from the development of roadside businesses. Of recent years this subject has received intensive study by various planning commissions, university professors, the auto clubs, and by other interested persons and organizations. The Department of Public Works has been concerned with the question for many years, but it is only in the past three years that even limited funds have been available for the accomplishment of any program towards protecting the borders of such highways from business encroachments.

The ordinary highway right of way differs from a railroad right of way in the important respect that abutting property owners have, under decisions of our Supreme Court, a right of access to the highway. This means that they may develop their property for business purposes, and in so doing are entitled to such connections as will permit vehicles to drive on and off the highway to their place of business. Vehicles coming into a fast-flowing stream of traffic create hazards, as well as interfering with the orderly flow of traffic on the highway. Due to the fact that the property owner has this legal right of access, the Division of Highways can not simply fence off the right of way as a railroad company can its right of way.

DIFFERENT METHODS TRIED

With the limited funds available, a substantial start has been made in the past three years towards meeting this problem. In practical application, several different methods have been tried. The simplest is the engineering solution of picking out a location for a highway where the existing conditions are such as to prevent any roadside developments. For example, highways have been laid out where one side of the road is protected by railroad right of way, or where both sides are protected by natural features such as a stream bed on one side and a steep bank of an arroyo or canyon on the other.

Another engineering solution which is being authorized is the construction of service roads outside of the lanes of the main highway, the service roads being physically separated from the lanes for through traffic by curbs or other means.

In certain instances, the problem has been attacked by condemning or buying from the abutting property all rights of access, so that the highway right of way can be fenced off or closed off as is a railroad right of way.

ZONING ORDINANCES ENACTED

Full credit must be given to the planning commissions and boards of supervisors in certain counties who have appreciated the seriousness of the problem of roadside development and who have attempted to provide a solution through the enactment of zoning ordinances. An ordinance prohibiting use of abutting highway property for roadside businesses does go a long way toward meeting this problem, although it can not provide the full measure of safety to traffic on a through highway which can be provided by the acquisition of the rights of access from the abutting property.

The Division of Highways has recently tried out in rural communities a simple procedure consisting of securing the agreement of abutting property owners not to use the property for the development of any roadside business, and authorizing the fencing off of the right of way by public authorities in the event any attempt is made to establish roadside businesses on the abutting property.

AGREEMENT LIMITATIONS

The general purpose of agreements of this sort is to hold the roadside property in its present use or to limit its use to purposes other than business purposes. For instance, if the property is in use for agricultural purposes it may, without violation of the agreement, be changed to residential purposes, but the possibility of residential subdivisions being laid out with each house having its own entrance onto the through highway is eliminated by provisions in the agreement limiting the number of approach roads which can be constructed from any particular property.

The plan last mentioned has been utilized recently for the protection of the new Vacaville Cut-off. While the primary consideration in attempting to so restrict the development of roadside businesses has been public safety and the preservation of the efficiency of the road for through traffic, in this case an additional return should be received by the motorists in the protection to the scenic values of the road through the orchards of the beautiful Vaca Valley.

WOULDN'T DARE

Doctor—Your wife seems to have eaten something that has disagreed with her.

Henpeck—Oh, no, doctor; it wouldn't dare to.—*Mentor.*

"There's something dove-like about our child."

"Yes, he's pigeon-toed."



This is how the realigned State Highway No. 4 (U. S. 99) south of the city limits of Modesto appeared when built in 1932.



The same portion of the highway as it appears today transformed into a 20-mile zone by business development.



Right of way agreements secured by Division of Highways protect the Vacaville cut-off through beautiful Vaca Valley from business encroachments.

Relation of Engineering to Accident Prevention

(Continued from page 13)

sight, hearing, et cetera; the others were apparently normal persons. It is this situation that prompted the statement that there seems to be so little good reason why such accidents occur.

The question of what the engineer can do to reduce their number is very hard to answer. The preventive measures which commonly suggest themselves to the engineer as things within his province are sidewalks, pedestrian crossings, and lighting. A brief general review of the pedestrian accident situation on the rural State highway system immediately demonstrates the serious difficulties to be encountered when we try to apply such remedies.

During the past year we received reports of 576 pedestrian accidents occurring on the rural portion of the State highway system. This involves over 13,000 miles of road in 57 counties. Pedestrian accidents were scattered throughout 48 of these 57 counties, no one of which accounted for more than 6 per cent, with the exception of Los Angeles where approximately 14 per cent of the total occurred. Moreover, within the counties themselves there is little concentration to be found. Only in rare instances are there even as many as two pedestrian accidents reported at the same point or within the same immediate vicinity.

GREATEST OBSTACLE

This lack of concentration presents the greatest of obstacles to the engineer. Sidewalks could be of help only in preventing that type of accident where the pedestrian was walking on or along the highway. This represents only a little more than one fourth of the total. With accidents scattered as they are, it would require thousands of miles of sidewalks to effect any large percentage of these. Also, there is real doubt as to whether many of those who now are found walking along the highway would use a sidewalk if it were available. They are only pedestrians temporarily until such time as they can induce a passing motorist to pick them up; and they prefer to be either on or very close to the traveled way, thinking they will be better able to



National Safety Council

induce a driver to slow down and give them a ride.

More than one-third of the pedestrians were killed or injured while attempting to cross the highway. These attempts were made everywhere. To provide a sufficient number of safe crossings for these pedestrians to effectually reduce this type of accident is just as overwhelming as the problem of sidewalks.

The third measure which might conceivably be of benefit, would be lighting of the highways. Since night-time accidents are no more concentrated than pedestrian accidents in general, lighting, to be of any marked benefit for this particular purpose, would have to be just as universal as sidewalks or safe crossings.

Pedestrian traffic on rural highways in California is vastly different from that in densely populated States, where what we would be inclined to consider as urban conditions exist along a very large percentage of all their rural highways. There are along our rural highways a very few points where pedestrian traffic is perhaps of sufficient volume to call for special consideration.

These places are being studied in detail to determine what reasonable measures may be taken to further safeguard this class of traffic, but the problem of accomplishing any marked reduction in pedestrian accidents for the rural highways of the State as a whole is one that will require much work other than that which can be brought about by any possible physical improvements. The engineer can contribute by clearly outlining the situation as it really exists, pointing out what he can do and is doing. Others must have a large part in solving this very difficult traffic problem.

The relation of scientific engineering to accident reduction appears to me to lie mainly in these two things:

First, to prepare by scientific method the necessary factual basis for a clear presentation of the whole traffic accident problem. Such a basis is vital, not only to the engineer for whatever subsequent action he is to take but also to all others engaged in any phase of accident prevention.

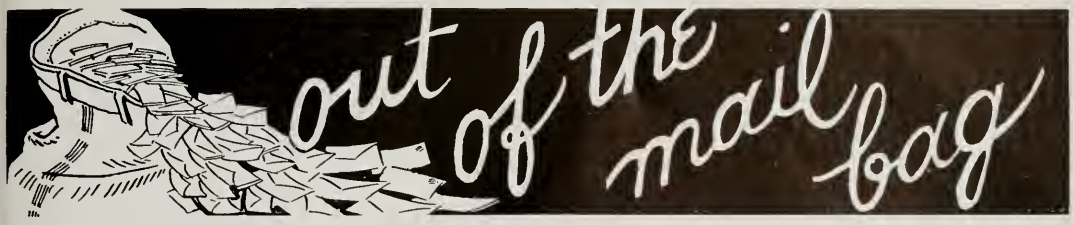
Secondly, as an engineer he must allocate his efforts and the expenditures under his control in such manner that they will return the maximum in total accident reduction.

The engineer will make frank recognition of his responsibility to so design, construct, and maintain the highways that they will to the most reasonable degree require and induce safe action on the part of the driver.

The driver at the same time must never be permitted to forget that the first and main responsibility lies with him. So long as he demands the right to drive a machine that will respond to his control, no amount of engineering on the part of some one else will ever provide him a guarantee of safety.

BAD ROADS KEEP 16,000,000 AMERICANS AWAY FROM CHURCH

Because of the important part played by the church in rural American life, the fact that many of our citizens are unable to attend church because of bad roads becomes especially serious, says Charles M. Upham, engineer-director of American Road Builder's Association. "Sixty per cent of the 32,000,000 farm people in the United States live on unimproved dirt roads which bad weather often makes completely impassable. This means that more than 16,000,000 Americans are unable to get to church during many months of the year."



August 4, 1938

Department of Public Works,
Sacramento, California.

Gentlemen:

On our way from Fresno to San Luis Obispo, about 20 miles out of Kettleman City, over the Cottonwood Pass, the foot and hand feed of our car became impaired, making it impossible for us to move, leaving us stranded in the suffocating heat of the desert.

Thanks to the State Highway workmen, Messrs. E. C. Henderson (equipment operator), and J. K. James (foreman), we were towed to shade where car was worked on and fixed so we could proceed on our way.

We wish you would publish in your "Department of Works" magazine that these gentlemen were more than courteous, obliging as well as skilled workmen, performing their duty and much more to the tax paying public, who should know the out of the ordinary services rendered.

Trusting you will give these State employees credit in your State publication, we are

Gratefully yours,

MRS. A. M. ROBLE,
WOODVILLE BOGARD,
O. K. FETHEWY.

India Wants It

Office Executive Engineer
Montgomery, B. D.
July 16, 1938.

California Highways
and Public Works.

Dear Sir:

Will you kindly send me a sample copy of your noted magazine for my perusal before I subscribe towards its issue.

Yours faithfully,

(Signed) CHAMPA LAL, I. S. E.,
Executive Engineer,
Montgomery Provincial
Division,
(B. D.) India.

Scotland Gets It

August 24, 1938.

California Highways
and Public Works,
Sacramento.

Gentlemen:

Having received your magazine for many months, I want to take this opportunity of expressing my appreciation for such a fine publication.

It may interest you to know that after reading every page, the magazine is sent to the automobile editor of one of the large daily newspapers of Glasgow, Scotland, and I assure you it is very much enjoyed.

Yours very truly,

JOHN M. GORDON.

Endorses Amendment

California Division
The Travelers' Protective Association
of America

August 17, 1938.

H. R. Judah, Chairman,
State Highway Commission,
Sacramento, California.

Dear Mr. Judah:

With reference to your article in the August, 1938, issue of the California Highways and Public Works magazine on page seven, permit us to endorse the proposed constitutional amendment protecting the gasoline tax revenues from being diverted.

We have several thousand members whom we will inform, and your Commission is free to use our endorsement to this amendment.

Respectfully,

ROBT. E. PFAEFFLE,
State Secty.-Treas.

Read to Students

San Bernardino,
August 16, 1938.

California Highways
and Public Works,
Sacramento, California.

Sirs:

For the past year I have had the pleasure of receiving your official journal CALIFORNIA HIGHWAYS AND PUBLIC WORKS. I have found the material contained therein most instructive. It has been a source of pleasure and pride to point out certain facts concerning our public highways which I read in your magazine to both my students and friends.

I should be very grateful to you to continue my name on your mailing list at my new address, 2906 North E Street, San Bernardino.

Sincerely,

(Signed) KENNETH V. DEARDORFF.

Gas Tax Does It

CALIFORNIA CHAIN STORES
ASSOCIATION, Inc.

San Francisco,
August 18, 1938.

Mr. H. Ray Judah,
Santa Cruz, California.

Dear Mr. Judah:

Several days ago I had the pleasure of driving over the new Livermore Pass road. It is certainly a fine piece of work and a most welcome addition to our state highway system. I drive a good many miles each month and that makes my gasoline bill considerable, but I never object to the gasoline tax because the results show up so splendidly in our highway system.

I hope you are able to continue until your plans for the entire State have been completed.

Yours very truly,

JOHN ARTHUR REYNOLDS.
JAR:LMH

Helpful to Library

THE UNIVERSITY OF WISCONSIN
University Extension Division

Madison, August 1, 1938.

Calif. Highways and Public Works,
P. O. Box 1499,
Sacramento, California.

Gentlemen:

The Department of Debating and Public Discussion of the University Extension Division is very anxious to secure three copies of: "Disastrous winter floods caused $8,000,000 damage to State highways and bridges; Damage to bridges heavy," by W. A. Douglass in California Highways for April, 1938; to use in connection with its regular loan package library serivce in this State.

We shall find this publication especially helpful and shall appreciate your cooperation.

The Department of Debating and Public Discussion is the state-wide library functioning agency of the University Extension Division. Our loan service is rendered to the residents of Wisconsin with no expense other than the return transportation, hence we have no budget item for the purchase of material.

If at any time we can reciprocate, we shall be happy to do so.

Very truly yours,

ALMERE L. SCOTT, Director,
Dept. Debating and Public Discussion.

Highway Worker Injured by Truck With Bad Brakes

Marion Robinson, a maintenance leadingman of the State Division of Highways with headquarters at Klamath, was directing the work of a maintenance crew engaged in patching the pavement about one mile north of the Humboldt-Del Norte County line on the Redwood Highway on July 8 when he was struck in the back by a tank truck driven by E. A. Marsh of Eureka, and was knocked to the pavement on his face. He was taken to a hospital in Crescent City, where an examination revealed a slight fracture of the skull to the right of his nose, a fracture in the top rib on his right side and severe bruises on his face and one leg. He was confined to the hospital by his injuries for nearly a month.

The crew Mr. Robinson was directing was working on the west side of the pavement and traffic was using the east side. "Men and Eqnipment Working" signs were in place about 600 feet from the work on both sides and flagmen were stopping all traffic and cautioning them to proceed slowly.

The driver of the truck stated that the vehicle he was driving had faulty brakes and that he was following four cars when the leading car stopped suddenly, and, in order to avoid colliding with the car ahead he was forced to turn into the west lane where the truck struck Mr. Robinson.

The driver was fined fifty dollars by Justice of the Peace Fleishman at Klamath for reckless driving, driving without proper brakes and driving without a proper horn.

Automotive industries in the United States last year ranked first as consumers of rubber, plate glass, nickel, lead, mohair, and steel, it is revealed in annual reports. In the manufacture of motor vehicles factories used 80 per cent of the rubber, 73 per cent of the plate glass, 28 per cent of the nickel, 31.4 per cent of the lead, 40 per cent of the mohair, and 20 per cent of all the steel consumed in the United States during 1937.

"We'll get more mileage out of life if we never shift our mouths into high gear until we're sure our brains are turning over."—Ex.

Landscape Project Provides Parking on Donner Summit

By H. DANA BOWERS, Landscape Engineer

THAT roadside improvement can serve the motorist from the standpoint of safety as well as augment the natural scenery is exemplified in a landscape project recently completed at Donner Summit on State Highway Route 37 (U. S. 40).

From the top of Donner Summit at an altitude of 7135 feet there is unfolded to the eastward a panorama of unexcelled grandeur and beauty. About 1000 feet below, beautiful Donner Lake nestles like a jewel in a magnificent setting of evergreen forest. For the past several years this captivating vista constituted a source of traffic and pedestrian hazard because thousands of tourists, desiring to stop and enjoy the view, were forced to do so in an entirely inadequate space.

To eliminate these hazards and to provide an area where motorists would have plenty of room to park and spend all the time they wished, a section of the solid granite point lying directly below the famous Donner Summit Bridge was blasted away. An area 75 feet wide and 150 feet long was provided with an entrance way designed for safety under present traffic conditions. This area was oil surfaced and protected with rubble piers, chain railing and a walkway.

In this connection it is interesting to note an article in the California Highways for September, 1926, referring to the Donner Summit Bridge then recently completed and setting forth its advantages from a scenic and safety standpoint. The following excerpt is revealing of the advance made in highway construction standards in the past twelve years.

> "High up amid the granite crags of the Sierra, Donner Summit Bridge, a forest highway project, is one of the unique structures on the State Highway System of California. It spans a rocky chasm at an elevation of nearly 7000 feet and was built to make possible a grade of not to exceed 7 per cent from Donner Lake to the Summit; eliminating for all time the 18 and 20 per cent grades of the old road, first projected in early days, and for years the most difficult section of the most important interstate connection in northern California. The bridge has a handsome arch 110 feet in length with a depth of 70 feet. Its cleared roadway width is 24 feet, its total length including approaches is 241 feet.
>
> "As a part of the lower approach span, there has been constructed an elevated observation platform 25 feet in length and 7 feet wide, on a pedestal of which a memorial tablet of the Native Sons is placed. Herein the motorists *may enjoy, safely guarded from the passing traffic, the marvelous view of the high Sierra and the Donner Lake basin which unfolds below.* It was near this spot that the Donner party turned back in October, 1846, balked by snow in its attempt to cross the summit. Because of the historical significance of this spot the observation platform was deemed appropriate. A wide parking place for automobiles also has been provided nearby * * *"

The "wide parking space" was a 12-foot shoulder on the opposite side of the bridge approach from the observation platform, making it necessary for visitors to cross the road and walk back to reach the observation platform.

The increase in traffic and the speed at which the modern automobile travels this road at the present time has changed a situation then considered comparatively free of danger into one of great hazard. Correction of this condition has been accomplished by the new improvement.

Parking area at Donner Summit lookout point on State Highway No. 37 (U. S. 40). Donner Summit bridge in background.



Huge crags originally barred access to point overlooking Donner Lake.



Rocks were blasted and safe entrance way and parking area constructed.

$300,000 for Flood Relief

Governor Frank F. Merriam on August 25th approved the immediate allocation of $300,000 from the $5,000,000 Emergency Flood Relief Fund for the restoration of flood damaged levees, structures and drainage canals and emergency bank protection along the Sacramento and Feather Rivers in the Sacramento River Flood Control Project.

The Governor announced his action at a conference attended by Director of Public Works Earl Lee Kelly, State Engineer Edward Hyatt, and a delegation of Yuba County citizens headed by Senator W. P. Rich of Marysville.

The $300,000 will be divided equally between the State Reclamation Board and the Division of Water Resources of the Department of Public Works.

Nine counties that will receive the direct benefit from the Governor's allocation are Butte, Glenn, Colusa, Sutter, Yuba, Yolo, Solano, Sacramento, and San Joaquin.

Twenty-five Year Club Formed in Highway Division

TO CELEBRATE a quarter century of service with the State and to establish a closer bond of friendship cementing twenty-five years employment by the same organization, a "Quarter Century Club" has just been organized by employees of the Division of Highways who began State service in 1912 or prior thereto, and had been in State service at least twenty-five years on December 31, 1937.

A prerequisite for membership in the club is twenty-five years service with the Division of Highways and all employees of the division are eligible for membership immediately upon acquiring the required service status.

It is of interest to note that of four hundred employees who entered the service of the State Highway Commission in 1912, the names of fifty-four were to be found on the 1937 employment roll. The majority of these 54 employees had not served continuously, but of the number, twenty-five had by December 31, 1937, served for 25 years; except when, in a few cases, on leave of absence during the World war.

During 1938, a number of others will attain the 25 year service credit.

Following are the names of twenty-one employees who had served at least twenty-five years on December 31, 1937, and who have participated in the formation of the club.

C. N. Ainley, Associate Highway Engineer, District VII, Los Angeles.
H. F. Allen, Associate Highway Engineer, District VII, Los Angeles.
F. R. Baker, Associate Highway Engineer, District IX, Bishop.
E. J. Bassett, District Office Engineer, District II, Redding.
T. A. Bedford, Senior Highway Engineer, Headquarters—Sacramento.
C. M. Butts, Associate Highway Engineer, District I, Eureka.
S. V. Cortelyou, District Engineer, District VII, Los Angeles.
S. Crespo, Maintenance Foreman, District II, Redding.
H. C. Darling, Associate Highway Engineer, District IV, San Francisco.
A. N. George, District Construction Engineer, District VII, Los Angeles.
F. W. Haselwood, District Engineer, District II, Redding.
R. W. Haverstick, Chief of Party, District VII, Los Angeles.
F. T. Maddocks, Senior Physical Testing Engineer, Headquarters—Sacramento.
Grant P. Merrill, Superintendent, District IX, Mojave.
C. P. Montgomery, Associate Highway Engineer, District VII, Los Angeles.
James Moriarity, Chief Clerk, District IV, San Francisco.
D. N. Sapp, Assistant Highway Engineer, District IV, San Francisco.
R. H. Stalnaker, Equipment Engineer, Headquarters—Sacramento.
T. E. Stanton, Materials and Research Engineer, Headquarters—Sacramento.
R. A. Tremper, Assistant District Maintenance Engineer, District II, Redding.
G. R. Winslow, Assistant Construction Engineer, Headquarters—Sacramento.

Uniform Code Recommended by W. A. S. H. O. Convention

(Continued from page 15)

were requested to give their views and to discuss the proposed provisions of a uniform code covering truck loads, widths, lengths and heights. Excellent cooperation was given in this matter by the carrier representatives and immediately after the opening meeting the committee agreed upon a recommended code to be adopted by the W. A. S. H. O.

On the following day, August 11th, the general meeting was addressed by Guy Kelcey of Signal Service Corporation on the subject: "Channelizing Traffic and Channel Lighting of Highways." After this came a discussion on the coordination of safety practices in eleven Western states and Texas which was joined in by representatives of practically all the states and resulted in a general agreement that a committee of W. A. S. H. O. should be formed to handle these matters.

In the afternoon the meeting was addressed by Charles Upham of the American Road Builders Association on the subject: "Streamline Traffic Demands Challenge the Highway Departments." Mr. Upham stressed the need for presenting data to show the necessity of future highway building in the Western states and said that unless this was done and members of Congress were convinced of the need, it was quite probable that Federal appropriations for such a purpose would be greatly curtailed in the future.

Following this address the report of the Committee on the Uniform Code covering axle loadings, widths, lengths and heights of truck was presented and was followed by a short discussion.

On Friday morning the meeting was addressed by Kenneth Godwin, Regional Engineer PWA, on the subject "Highway Construction Under PWA," and the program was concluded with a discussion of "Coordination of Safety Practices in Eleven Western States and Texas," which was participated in by representatives of practically all of the states represented.

At the request of Mr. Allen, this discussion was opened by Attorney Frank B. Durkee of the legal staff of the California Department of Public Works, who presented auditing and other related problems which have arisen in an attempt to comply with General Administrative Memorandum No. 39, particularly paragraph 39 of the memorandum dealing with reimbursement of public utilities.

The subject was closed with a discussion of the practices of the several states regarding the fencing of highways, particularly with reference to the maintenance of right of way fences.

Three resolutions were then presented by the resolutions committee and adopted. Resolution No. 1 recommending the uniform load dimension code is printed on a preceding page. Resolution No. 2 urged the American Road Builders' Association to hold its next convention and exhibit in San Francisco. Resolution No. 3 commended the American Automobile Association and affiliates for consistently fighting the diversion of road funds to other uses than road purposes.

The following officers were elected for the ensuing year: President, Charles D. Vail, State Highway Engineer of Colorado; Vice President, Joseph Stemmer, State Highway Engineer of Idaho; Secretary-Treasurer, George T. McCoy, Assistant State Highway Engineer of California.

He—Ants are supposed to be the hardest working creatures in the world.

She—Yep; but they still seem to have time to attend all picnics.—*Washington Post.*

Highway Work in 89th Fiscal Year Reported to Governor Merriam

THE 89th fiscal year of State government in California ended on June 30th last and also marked the mid point of the current fiscal biennium.

In his report to Governor Frank F. Merriam, Director Earl Lee Kelly of the Department of Public Works, stated that construction and maintenance activities of the Division of Highways were pushed ahead during the first year of the biennium to the end that work placed under way, as represented by work orders written, amounted to the total of $34,216,800 for maintenance and construction on the State Highway System.

Segregation of this amount in authorized expenditures for construction and maintenance to the various classifications of highway work is shown in the following tabulation:

Work Orders Issued

July 1, 1937, to June 30, 1938

State Highway Construction and Maintenance Contracts	$18,879,500
Day Labor Minor Improvements	603,800
Day Labor Betterments	690,400
Miscellaneous Day Labor Construction	1,919,700
Convict Construction	1,612,000
Construction subtotal	$23,705,400
Day Labor Maintenance	10,176,400
Maintenance and Operation of San Francisco-Oakland Bay Bridge	335,000
Total	$34,216,800

The $18,879,500 required for the 258 contracts awarded during the 89th fiscal year provided for various types of construction and improvement as shown in the following summary giving the mileage and amount for each type.

Type of construction	Miles	Amount
Pavement	164.3	$6,205,400
Plant-mix surfacing	178.3	3,192,500
Road-mixed surfacing	125.9	3,014,300
Oiled gravel surfacing (armor coat, etc.)	469.5	1,058,900
Untreated gravel or stone surfacing	17.5	48,100
Graded roadbed	58.7	866,100
Dust oiled roadbed	56.2	9,200
Shoulder construction and oiling	79.2	48,100
Bridges and grade separations	(79)	4,145,200
Miscellaneous		291,700
Totals	1,149.6	$18,879,500

The type designations in the above tabulation are based on the surfacing of the complete improvement and in each instance includes the necessary grading, drainage and base construction required for any given project. On certain contracts, even though the grading, base and construction of drainage structures may have been the major portion of the work, the improvement has been included under the surface type. Listed shoulder improvements include contracts involving work on shoulders only.

The financing of these contracts from the various sources of revenue is shown in the following tabulation:

State Highway funds	$10,682,600
Regular Federal Aid funds	6,095,700
Federal Grade Crossing funds	1,291,700
Federal Feeder Road funds	809,500
Total	$18,879,500

The State highway funds listed in the above tabulation include allotments from money allocated to the Division of Highways from revenues of the State gasoline tax and motor vehicle registration fees.

To complete the monthly records of activities of the division for the fiscal year just ended, the following data are given for the work accomplished during the month of June.

Work placed under way between June 1 and June 30, 1938, is represented by the amount of $4,762,000, which covers construction and maintenance work orders written and projects advertised for bid opening in July. This total includes activities from the various phases of State highway activities as shown in the following summation:

Construction		
Contracts awarded	$1,240,600	
Minor Improvements	29,200	
Miscellaneous day labor construction	446,500	
Subtotal		$1,716,300
Advertised for Bid Opening in July		2,008,100
Maintenance		
General Maintenance	$449,200	
Replacements	288,800	
Betterments	233,500	
Slide Removal	38,100	
Buildings and Plants	3,000	
San Francisco-Oakland Bay Bridge Operation and Maintenance	25,000	
Subtotal		*1,037,600
Total		$4,762,000

* Includes $114,900 in maintenance and betterment work let to contract.

Old Timer Had to Buy His Own Maintenance Outfit

Rodeo, Calif.
August 15, 1938

Mr. Jno. H. Skeggs
District Engineer, District IV

Dear Mr. Skeggs:

I received your letter advising me of a raise in wages and I want to thank you for your interest in my behalf.

Now let us review the past. In the spring of 1916, I took over the maintenance of the highway from Santa Rosa in Healdsburg and Cloverdale to Mendocino County line. Mr. C. C. Cottrell* informed me I would receive $4.00 per day and I would have to furnish my own maintenance outfit.

I paid $140.00 for a horse and buckboard, then there was hay to buy. With a wife and two children and rent to pay, I often wonder how I got by.

The new order of things is taken as a matter of course by present highway workers. With fine trucks, etc., they little know of the hardships of the early days.

All this, Mr. Skeggs, that you may know how I appreciate what I receive.

Sincerely,

J. D. WILLIAMS,
Construction Superintendent.

* Now with California State Automobile Association.

"Say, dat guy busted the crystal of me watch. What should I do to him?

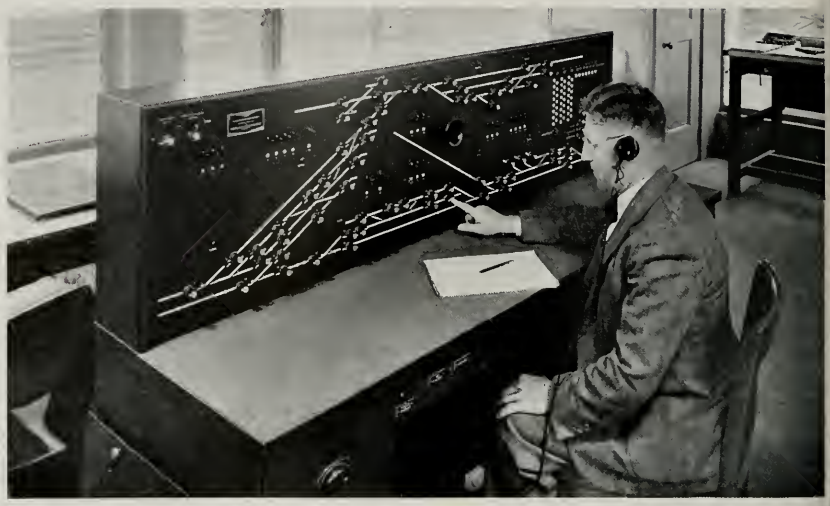
"Go ahead, give him de woiks."—*Texas Longhorn.*

Bay Bridge Train Movements Controlled By Push Buttons

THE old switch tower, with its complicated rows of levers, will be replaced in the operation of the San Francisco-Oakland Bay Bridge electric railway system by two specially designed control boards.

One of these boards has been installed in the signal tower of the East Bay Yard opposite the Bay Bridge toll plaza. The other will be placed in the San Francisco terminal building on the track floor.

The long rows of mechanically interlocked individual levers will be succeeded by an all-relay route control system operated by controls arranged directly on a track diagram.



Control board 6½ feet wide operating electric routing and switching of Bay Bridge trains.

To set up a route by the control board, it is necessary only to press in the signal knob at the entrance to the route and the completion button at the exit from that route. The light in the signal knob will flash on instantly and will continue flashing until the switches are properly set and the signals are cleared. It then becomes a steady light.



A mechanical lever system would have required 92 levers and 60-foot switch tower.

AUTOMATIC OPERATIONS

When the train accepts the signal and enters the route, which is made visible on the board by occupancy lights, the signal returns to the stop indication and when the train has passed entirely through the route, the pressed-in knob is released and is ready for another operation.

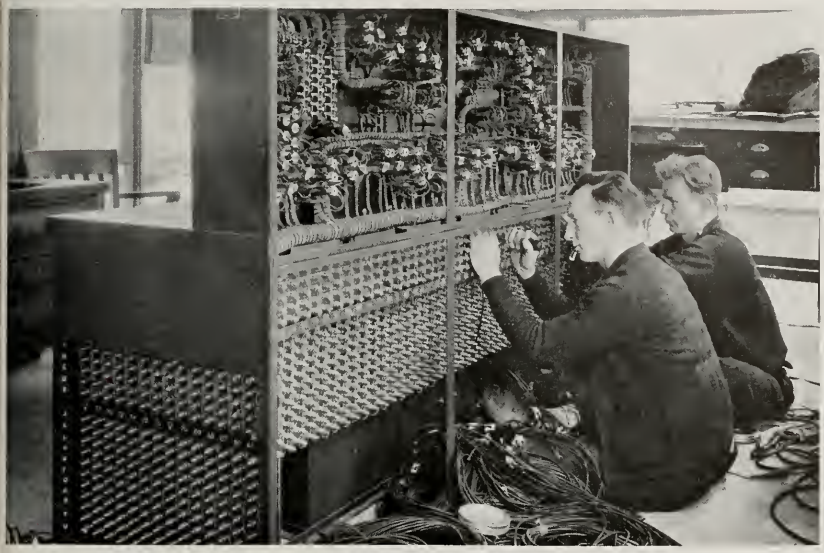
Under the new system it is possible to set up a route for a succession of trains. When this is done, the signal knob is rotated 90 degrees rather than pushed in; but the completion button is operated as for one train.

The wayside signal will automatically clear for the next train while the route remains locked.

An additional feature on each of the control boards is a train identifier system. The tower operator must know the identity of each train as it approaches in order to route it according to the train traffic schedule.

TRAIN CLEARING SYSTEM

In the case of westbound trains, as each train leaves the Oakland yard the Oakland operator, in clearing the train, also identifies it. This identity is transmitted to the San Francisco tower by means of lights appearing on the control board each of which bears the number or letter of the train—the Key System trains operating by letter, Interurban Electric (S. P.) by number. As each train enters the San Francisco interlocking area its identification is canceled.



Rear view showing complicated wiring system of 6½-foot control board.

Had the mechanical lever system been used on the Bay Bridge trains, for the operation of the Oakland interlocking plan alone, it would have been necessary to have utilized 92 levers in a tower 60 feet long. The Oakland control board is 6½ feet in length and the San Francisco board is of similar length.

Each board contains the design of the track system for that particular interlocking area. In the case of the former, it includes all trackage in the East Bay Yard and in the case of the latter, the track system for the San Francisco loop, comprising that area from the bridge proper to the terminal building.

Bay Bridge Traffic Shows Increase Over Previous Month

TRAFFIC and revenues for the San Francisco-Oakland Bay Bridge last month reached a highpoint for the year, it was announced by Earl Lee Kelly, State Director of Public Works. A total of 777,363 vehicles crossed the bridge in August, Mr. Kelly said, producing revenues amounting to $405,065.60. An average of 25,076 vehicles crossed the span every day. Comparative figures and totals are shown below.

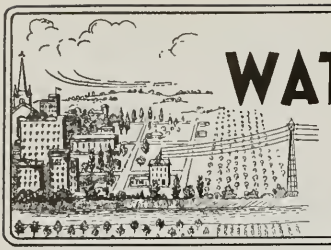
	Total August	Total July	Total since Opening
Auto Trailers	1,848	1,829	26,299
Passenger Autos	693,297	667,608	14,913,556
Motorcycles	2,994	3,034	55,590
Tricars	1,167	1,001	17,290
Buses	13,432	13,467	194,032
Trucks	39,863	34,414	563,228
Truck Trailers	1,768	1,538	32,939
Toll Vehicles	754,369	722,891	15,802,934
Auto Passes	21,089	17,552	208,100
Truck Passes	1,905	2,029	20,305
Total Vehicles	777,363	742,472	16,031,339
Extra Passengers	244,728	241,163	3,793,908
Freight Pounds	111,016,500	87,499,250	1,374,747,659

The August report of traffic compiled by State Highway Engineer C. H. Purcell, however, indicated a drop from last year's figures, which showed that 853,579 vehicles crossed the bridge during August, 1937, averaging 27,535 vehicles a day, with revenues totaling $453,213.40.

August traffic figures bring the total number of vehicles to cross the span to date to 16,031,339.

Freight increased to 111,016,500 pounds during last month, with the number of trucks and truck trailers totaling 41,631.

Both truck travel and freight pounds showed an increase over July, 1938, which had a total of 35,952 trucks and trailers and 87,499,250 freight pounds. August figures also represented an increase of more than 42,000,000 freight pounds and approximately 13,000 trucks and trailers over the corresponding period last year.



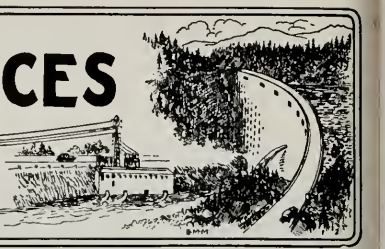
DIVISION OF WATER RESOURCES

OFFICIAL REPORT

FOR THE MONTH OF

August, 1938

EDWARD HYATT, State Engineer



INVESTIGATIONS of applications for allotments for money appropriated to the Emergency Fund for the restoration of public property, levees, flood control works, county roads and bridges, damaged by floods of the past season, throughout the State, and the supervision of the restoration work, have been continued by the Division of Water Resources representing the Department of Public Works, pursuant to the instructions from the Director of Finance.

Allocations totaling $3,698,200 have been approved by Governor Frank F. Merriam for flood damage repair work pursuant to these reports and recommendations. Some of the work for which these allocations have been made are being performed by the Division of Water Resources and other work is being done by the applicant under contracts entered into by the Department of Public Works. Seventy-five of these contracts are now in force, work for which will cost $1,879,300.

IRRIGATION DISTRICTS

Inspection of structures in the Mountain Division of Nevada Irrigation District was made during the month where repairs occasioned by storm damage of the past winter were under way. The district has submitted for approval a new project involving construction of a dam on Deer Creek and a diverting canal below Combie Dam on Bear River. Application has been made to PWA for a grant and loan in the amount of $460,000 to carry out construction.

SUPERVISION OF DAMS

Applications have been received for the enlargement of the Jackson Lake Dam in Nevada County and Mountain King Dam in Calaveras County.

Applications for the repair and alteration of the White Dam in Modoc County and Sawmill Lake Dam in Nevada County, and for the repair and alteration of the Sawpit and Big Santa Anita Dams, both in Los Angeles County, have been approved.

Certificate of approval of Bonita Canyon Dam was issued on August 1, 1938.

WATER RIGHTS

Twenty-three applications to appropriate were received during July; 14 were denied and 15 were approved.

Among the applications received were one by the Shafter-Wasco Irrigation District in Kern County, one by the Southern San Joaquin Municipal Utility District in Kern County, and one by the South Santa Clara Water Conservation District in Santa Clara County. Among the applications approved was one by the Hollister Irrigation District in San Benito County.

Seventeen licenses were issued during July.

SACRAMENTO-SAN JOAQUIN WATER SUPERVISION

During the past month all efforts of this office have been in the field gathering data from which to make a record of the amount of water diverted from the streams in the Sacramento and San Joaquin Valleys. This report will also show the amount of land irrigated, the return flow therefrom and also the flow in the valley streams. The sampling of water in the delta for salinity is being carried on at a number of stations sufficient to record the rate of advance of the salinity. At intermittent intervals samples of drainage and return flow water are being obtained in the Sacramento and San Joaquin Valleys.

CALIFORNIA COOPERATIVE SNOW SURVEYS

During the past month, work has begun in the mountains in preparation for next winter's snow surveys. Snow courses are being brushed out and old markers replaced with new ones where required.

The snow courses maintained and measured by the San Joaquin Light and Power Corporation in the watershed of the North Fork of the Kings River have been inspected and arrangements concluded for the cooperative building of a new shelter cabin in this region at Burnt Corral Meadows.

Arrangements were made with the Sierra National Forest to conduct an annual snow survey in the upper regions of the Middle Fork of the San Joaquin River, and new snow courses were established at Beysore Meadows, Chiquito Creek, Jackass Meadows, Clover Meadows and Cora Lakes.

CENTRAL VALLEYS PROJECT

Working under a cooperative agreement with the U. S. Bureau of Reclamation, the Division of Water Resources, representing the Water Project Authority of the State of California, has continued engineering studies in connection with the Central Valleys Project. The work has comprised the obtaining of data in the field and its analysis for use in connection with negotiations for the acquisition of water rights on the lands bordering the San Joaquin River. Studies have been continued of matters affecting the disposal of water made available by the project including analyses of present ground water conditions and the requirements of certain areas for additional supplies. Negotiations have been continued with public utility companies for the relocations of their facilities affected by the construction of certain units of the project.

FLOOD CONTROL AND RECLAMATION

Maintenance of Sacramento Flood Control Project

Routine maintenance on the flood control project has been carried on during this period with a considerably reduced crew. Temporary repairs have been made to several bridges in the by-pass so that stock can be crossed.

Relief Labor Work

An average of 48 relief laborers have been employed in clearing in the Feather River overflow channel during this period.

Emergency Levee Repairs

Under Executive Order E-177, work has continued in repairing flood damage in Glenn, Shasta, Butte and Tehama counties. It is expected that this work will be terminated by October 1, 1938.

Bank Protection work under the State-Federal agreement of 1932 has proceeded during this period, at the Burkes ranch in Reclamation District No. 70, where 750 feet of bank protection has been installed, and at Eldorado Bend in Reclamation District No. 108, where the installation of 800 feet of protection is nearing completion.

Sacramento Flood Control Project Construction

The work being done by Claude C. Wood, under contract, in filling the borrow pit on the Burr Mitchell ranch north of Colusa, was completed on August 24, 1938.

Highway Bids and Awards for the Month of August, 1938

ALAMEDA COUNTY—Between Castro Valley Junction and San Leandro, about 3.5 miles to be graded and paved with asphalt concrete and portland cement concrete. District IV, Route 5, Section D. Frederickson and Westbrook, Lower Lake, $275,947; Granfield, Farrar and Carlin, San Francisco, $281,526; Union Paving Co., San Francisco, $284,551; David H. Ryan, San Diego, $285,271; N. M. Ball Sons, Berkeley, $294,750; Hanrahan Co., Redwood City, $298,751. Contract awarded to Jones and King, Hayward, $269,769.25.

BUTTE COUNTY—Between 0.7 mile north of Biggs and State Highway Route 45, about 3 miles, a gravel base and armor coat to be constructed. District III, Feeder road. Piazza and Huntley, San Jose, $19,349; Lee J. Immel, Berkeley, $20,962; E. A. Forde, San Anselmo, $21,734; Hemstreet and Bell, Marysville, $21,760; Claude C. Wood, Lodi, $22,413; Independent Construction Co., Ltd., Oakland, $22,639; N. M. Ball Sons, Berkeley, $22,853; E. B. Bishop, Orland, $24,982; J. R. Reeves, Sacramento, $33,129. Contract awarded to Charles Kuppinger, Lakeport, $18,217.50.

LASSEN COUNTY—Between State Highway Route 28 at one mile northeast of Bieber and 2¼ miles northerly, about 2.5 miles to be graded and surfaced with road-mix surfacing and a seal coat to be applied. District II, Feeder road. Bernard H. Miles, Oakland, $19,198. Contract awarded to Poulos and McEwen, Bieber, $18,481.10.

LOS ANGELES-SAN BERNARDINO COUNTIES—Two spans of existing three-span bridge across San Antonio Creek at Pomona, consisting of one 37-foot span and one 27-foot span on concrete bents and abutments and portions of roadway approaches to be graded and surfaced with portland cement concrete pavement. District VIII, Route 19, Section Pom.,A. W. E. Robertson, Los Angeles, $19,817; Byerts and Dunn, Los Angeles, $16,979; E. S. & N. S. Johnson, Pasadena, $19,652; Oberg Bros., Los Angeles, $20,387; J. S. Metzger & Sons, Los Angeles, $18,898; C. T. and W. P. Stover, Claremont, $17,750; The Contracting Engineers Co., Los Angeles, $20,479; J. E. Haddock, Ltd., Pasadena, $15,997. Contract awarded to Paul D. Lawrence Co., Los Angeles, $14,120.60.

LOS ANGELES COUNTY—Sepulveda Blvd. between San Fernando Road and Brand Blvd., 3.7 miles to be paved with portland cement concrete, plant mixed surfacing and asphalt concrete. District VII, Route 158, Section L.A. Geo. R. Curtis Paving Co., Los Angeles, $108,056; J. E. Haddock, Ltd., Pasadena, $112,193; Gogo and Rados, Los Angeles, $109,209; C. O. Sparks and Mundo Engineering Co., Los Angeles, $115,848; Griffith Co., Los Angeles, $107,256; Gibbon and Reed Co., Burbank, $122,948; Oswald Bros., Los Angeles, $114,927; Vido Kovacevich, South Gate, $110,424; United Concrete Pipe Co., Los Angeles, $115,067.00. Contract awarded to Matich Bros., Elsinore, $106,598.00.

MARIPOSA COUNTY—Between Briceburg and El Portal, about 12.4 miles to be graded and surfaced with a mixture of the existing surfacing material and untreated crushed gravel or stone. District X, Route 18, Sections E,F,G,H. Granfield, Farrar and Carlin, San Francisco, $538,642; United Concrete Pipe Corp., Los Angeles, $669,827; George Pollock Co., Sacramento, $707,840; J. E. Haddock, Ltd., Pasadena, $925,719. Contract awarded to Mittry Brothers Construction Co., Los Angeles, $509,744.75.

MENDOCINO COUNTY—Between Navarro and Maple Creek, about 6.3 miles to be graded, penetration oil treatment applied and reinforced concrete bridges to be constructed. District I, Route 48, Sections C,B,A. Claude C. Wood, Lodi, $167,284; Hemstreet and Bell, Marysville, $176,184; N. M. Ball Sons, Albany, $177,855; Guerin Bros., San Francisco, $191,658. Contract awarded to Johnston Rock Co., Inc., Stockton, $153,854.80.

MENDOCINO COUNTY—A reinforced concrete box girder bridge across South Eel River nine miles northeast of Longvale and approaches. District I, Feeder road. Albert Siemer and John Carcano, San Anselmo, $49,999; Bennett and Taylor, Glendale, $60,666; Robert McCarthy, San Francisco, $64,628; B. A. Howkins, San Francisco, $95,381; Campbell Construction Co., Sacramento, $62,545. Contract awarded to Fred J. Maurer & Son, Eureka, $47,548.60.

MONTEREY COUNTY—Over Welby Hill, about 4.6 miles south of King City, about 0.9 mile to be graded and surfaced with natural rock asphalt. District V, Route 2, Section F. Macco Construction Co., Clearwater, $40,850; N. M. Ball Sons, Berkeley, $41,180; L. A. Brisco, Arroyo Grande, $42,865; C. R. Butterfield-Kennedy Co., San Pedro, $45,463. Contract awarded to Granite Construction Co., Watsonville, $37,978.

ORANGE COUNTY—A reinforced concrete girder bridge across Santa Ana River two miles north of Newport Beach to be repaired. District VII, Route 60, Section A. The Robertson Co., Los Angeles, $56,483; Byerts & Dunn, Los Angeles, $59,635; Contracting Engineers Co., Los Angeles, $72,449; W. E. Robertson, Los Angeles, $55,910. Contract awarded to G. E. Kerns, Long Beach, $40,736.00.

ORANGE COUNTY—A bridge across San Juan Creek 11 miles east of San Juan Capistrano to be repaired and approaches graded and surfaced with plant-mixed surfacing. District VII, Route 64, Section B. Dimmitt & Taylor, Los Angeles, $22,355; Byerts & Dunn, Los Angeles, $25,448; Gibbons and Reed Co., Burbank, $18,960; Macco Construction Co., Clearwater, $20,452; E. S. and N. S. Johnson, Pasadena, $21,944; Contracting Engineers Co., Los Angeles, $26,674; W. E. Robertson, Los Angeles, $20,507. Contract awarded to A. L. Gabrielson, Arlington, $18,193.23.

PLACER COUNTY—Between 0.6 mile east of Roseville and Rocklin, about 2.3 miles to be graded and paved with portland cement concrete. District III, Route 17, section A,Rec. Louis Biasotti & Son, Stockton, $88,884; N. M. Ball Sons, Berkeley, $87,352; A. Teichert and Son, Inc., Sacramento, $91,073; A. G. Raisch, San Francisco, $98,479. Contract awarded to Frederickson & Westbrook, Lower Lake, $78,618.40.

PLACER COUNTY—Over the Southern Pacific Co. tracks at Colfax, a steel girder and reinforced concrete deck overhead crossing to be constructed. District III, Route 37, Section B,Cfx. A Teichert & Son, Inc., Sacramento, $132,045; John Rocca, San Rafael, $133,142; J. F. Knapp, Oakland, $132,450; M. B. McGowan, Inc., San Francisco, $123,131; P. J. Walker Company, San Francisco, $126,623; B. A. Howkins & Co., San Francisco, $123,834; Holdener Construction Co., Sacramento, $130,390; Bates and Rogers Construction Corp., Oakland, $130,052. Contract awarded to Campbell Construction Co., Sacramento, $117,881.70.

PLUMAS COUNTY—Between 0.3 mile north of Spanish Creek and Quincy, one mile to be surfaced with road-mix surfacing and Class "A" seal coat. District II, Plumas County, Route 21, Section C. Hayward Building Material Co., Hayward, $6,762; Claude C. Wood, Lodi, $5,425; Lee J. Immel, Berkeley, $5,558; Garcia Construction Co., Irvington, $5,358. Contract awarded to Harms Bros., Vinton, $5,205.00.

PLUMAS COUNTY—At Greenville, a steel girder overhead crossing with concrete deck over tracks of Western Pacific R. R. Co., a steel girder bridge with concrete deck across Wolf Creek and about 0.4 mile of roadway to be graded and surfaced with screened gravel and roadmix surfacing. District II, Route 83, Section B. A. Soda and Son, Oakland, $124,631; John Rocca, San Rafael, $127,501; Johnston Rock Co., Inc., Stockton, $130,944; B. A. Howkins & Co., San Francisco, $148,257. Contract awarded to George Pollock Co., Sacramento, $117,584.85.

SAN BERNARDINO COUNTY—A reinforced concrete girder bridge at Santa Ana River one mile east of Colton. District VIII, Route 26, Section E. R. H. Travers, Los Angeles, $92,380; Dimmitt & Taylor, Los Angeles, $89,996; Mittry Bros. Construction Co., Los Angeles, $85,610; J. E. Haddock, Ltd., Pasadena, $84,097; Person & Hollingsworth Co., Los Angeles, $74,688; Byerts & Dunn, Los Angeles, $86,340; Gibbons and Reed Co., Burbank, $81,679; Macco Construction Co., Clearwater, $70,894; Oswald Bros., Los Angeles, $78,935; United Concrete Pipe Corporation, Los Angeles, $85,252. Contract awarded to Vinson and Pringle, Phoenix, Arizona, $67,903.24.

SONOMA COUNTY—Across Russian River at Cloverdale, a bridge to be constructed; about 0.3 mile to be graded. District IV, Feeder road. Fred J. Maurer and Son, Eureka, $93,076; Chas. L. Harney, San Francisco, $96,217; J. H. Pomeroy & Co., Inc., San Francisco; $102,143; M. B. McGowan, Inc., San Francisco, $101,419; E. T. Lesure, Oakland, $96,392. Contract awarded to A. Soda and Son, Oakland, $86,940.84.

SURPRISING ACCIDENT FACT

While it is the human tendency to blame the other driver for most traffic mishaps, national statistics show that motor vehicle deaths resulting from collisions with fixed objects have increased more rapidly than any other type of motor vehicle death, according to a recent report. During the ten-year period from 1927 to 1937 this type of fatality has increased 244 per cent with 3750 deaths and 95,000 injuries occurring last year alone.

"Waiter."

"Yes, sir?"

"Have you ever been to the zoo?"

"No, sir."

"Well you ought to go sometime. You'd get a big kick out of watching the turtles zip past."

"If someone left you a million dollars, what would you do?"

"Hire six good lawyers, and try to get it."

Highways and Bridges Would Cost $67,409,200

(Continued from page 3)

To bring the roads, bridges and other structures in the district up to adequate standards to meet present day needs would require expenditures far in excess of funds now available as may be readily seen by reviewing the following tabulation:

365 miles	2-lane New and reconstruction	$16,607,500
58 miles	3-lane Reconstruction	3,480,000
68.5 miles	4-lane Divided, new and reconstruction	12,032,500
36.5 miles	6-lane Divided, new and added construction	8,843,200
97 miles	2 to 3 lanes Widening and reconstruction	4,365,000
75 miles	2 to 4 lanes Widening and reconstruction	5,625,000
40.7 miles	3 to 4 lanes Widening and reconstruction	5,956,000
40	Highway grade separations	6,000,000
	Railroad grade separations and major bridges	4,500,000
		$67,409,200

The total funds required in the amount of $67,409,200 relates to the present system only. There are, however, a number of our heaviest traveled arteries connecting concentration centers by meandering or circuitous routings, which will require relocation to eliminate loss in time, hazards, excess distance, numerous crossroads and congestion. Large right of way and construction cost is involved in such relocation and these costs are not included in the above total.

Previous biennial budget appropriations have been inadequate to meet traffic requirements. Expenditures for the 85th-86th (1933-35) fiscal years budget for major construction projects totaled $6,551,770. In the following biennium, 87th-88th (1935-37), the district construction expenditures totaled $6,136,800.

The comparison between our actual construction requirements and our biennial allotments indicates that immediate relief is not in sight if present resources or revenue remain unchanged.

Traffic Cop: "Use your noodle lady! Use your noodle!"

Lady: "My goodness! Where is it? I've pushed and pulled everything in the car."

Doctor: "I will examine you for ten dollars."

Patient: "Go ahead. If you find it, I'll give you half."

In Memoriam
Burton A. Towne

August 1, 1938, marked the passing of Burton A. Towne, first Chairman of the California Highway Commission.

August 2, 1911, Mr. Towne was chosen by Governor Hiram W. Johnson as one of the three appointed members of the Advisory Board of the State Department of Engineering, who then were named an executive committee to be known as the California Highway Commission in immediate charge of the expenditure of the first $18,000,000 state highway bond issue.

Mr. Towne was selected to be Chairman of this first commission, the members of which had been chosen carefully by Governor Johnson for their outstanding fitness and integrity to handle this important new State enterprise, and who, with such rare foresight and forthright purpose, assembled the working personnel, and adopted the basic policies which have contributed so greatly to keep the State highway activities on the high plane that has ever since characterized them.

Mr. Towne brought to this first commission actual experience in successful roadbuilding in connection with the construction of the first county system of paved roads in San Joaquin County, one of the pioneer counties in systematic county road development in California.

After the State highway work had been satisfactorily launched, January 14, 1914, Mr. Towne retired from the commission so that he could concentrate his attention upon his large business and agricultural interests.

Never thereafter, however, did he lose interest in the continuation of a high standard of road development in California, and later served for a number of years as a director and also as president of the California State Automobile Association, and contributed to the orderly and scientific development of California's highways and the betterment of traffic conditions for the motoring public.

Mr. Towne was born in St. Paul, Minnesota, sixty-four years ago, attended the University of Minnesota, and was a member of the Delta Kappa Epsilon fraternity. He came to California and later married the former Alice Weinstock, member of a well-known Sacramento family.

He moved to the Lodi district thirty-five years ago and his home and vineyards became show places in San Joaquin County. Besides Mrs. Towne, two sons, Burton A., Jr., of Lodi, and Horace D. of Walnut Grove, survive him.

Sharp Reversal Noted in Attitude to Highway Funds

WITH the lessening of the property tax as a major source of highway revenue, more and more States have found it necessary to assist minor units of government in the financing of secondary and local roads, states Wilfred Owen of the Highway Research Board in an official publication. This has been accomplished either by grants of State-collected motor vehicle taxes to the counties and townships, or, in several instances, through the assumption of local road mileages by the State highway department.

Such a shift from local financing to State support has naturally reduced the amount of vehicle taxes available to the State highway departments for their primary systems. Added to this partitioning of the road dollar, the use of vehicle taxes for other than highway purposes has accentuated the drain on trunkline resources.

Fortunately during this period of unstable financing, gaps have been filled to a large extent by Federal aid, including both regular allotments and emergency work relief funds.

The serious implications in this trend were foreseen in Michigan last year by the State legislature. Recognizing the fact that State motor vehicle taxes had to a large extent replaced property and other local levies, and realizing the value of the primary road system as a state-wide general asset, the legislature appropriated from the general fund the sum of $5,000,000 for the fiscal year 1938, and for each year thereafter.

Last month it was the payment of a $1,750,000 general fund installment to the Highway Department which enabled Michigan to match its Federal aid allotment.

Prof.: "What are the properties of heat and cold?"

Stude: "Heat expands and cold contracts."

Prof.: "Correct. Give an example."

Stude: "In summer, when it's hot the days are long, and in winter when it's cold the days are short!"

STATE OF CALIFORNIA

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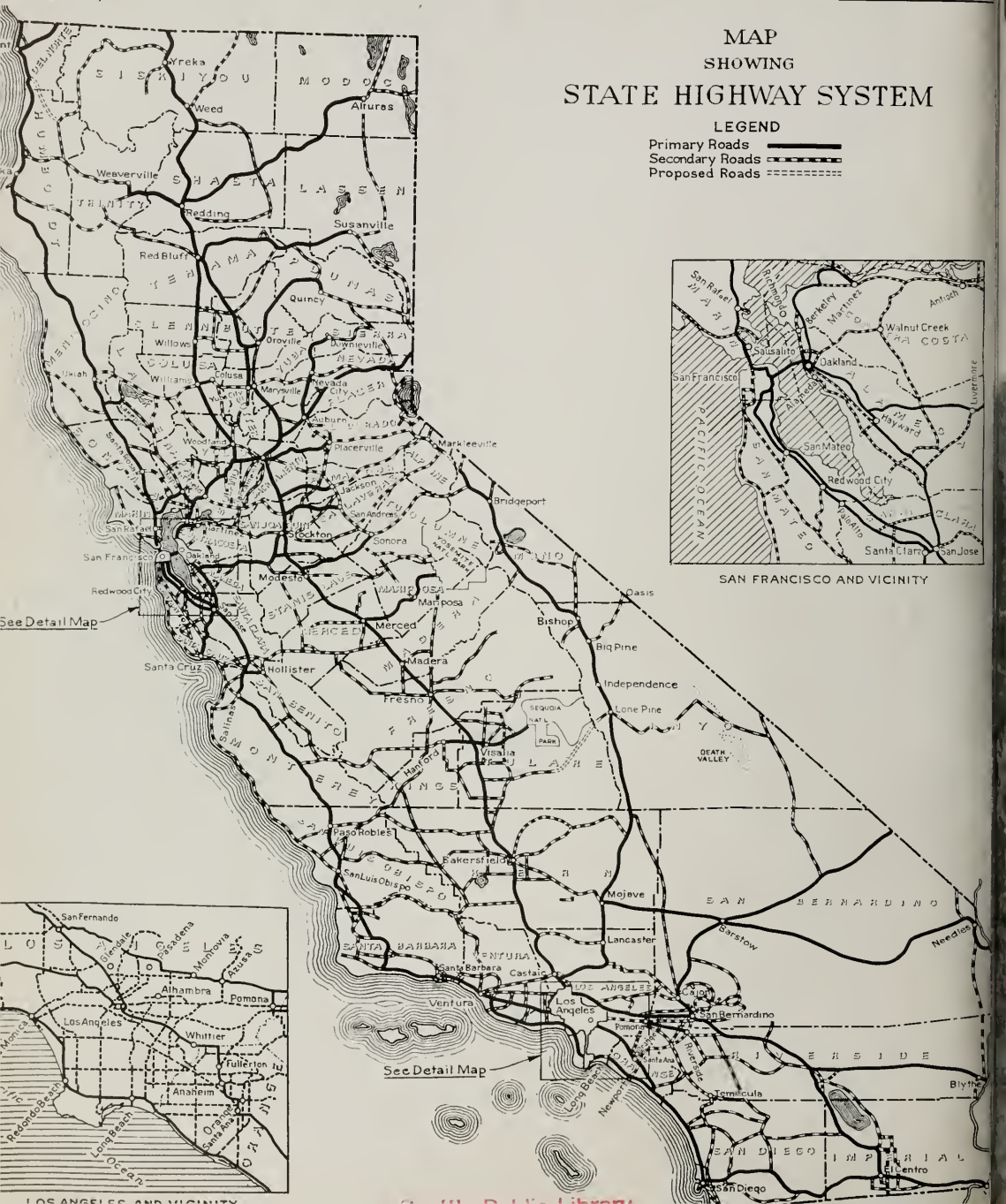
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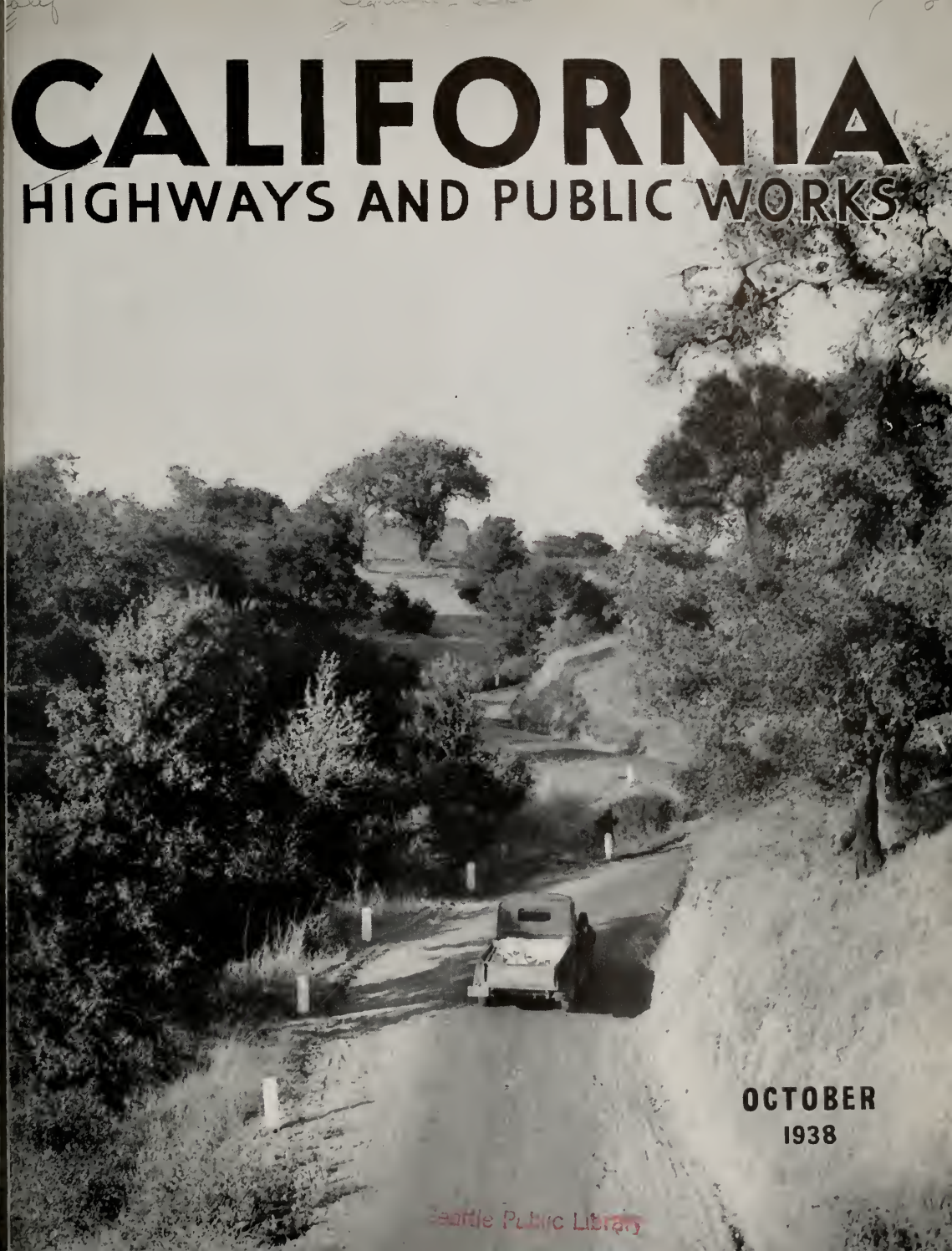
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LEGEND
Primary Roads
Secondary Roads
Proposed Roads



CALIFORNIA
HIGHWAYS AND PUBLIC WORKS



OCTOBER
1938

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CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways of the Department of Public Works, State of California

EARL LEE KELLY, Director C. H. PURCELL, State Highway Engineer JOHN W. HOWE, Editor K. C. ADAMS, Associate Editor

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Lack of Funds Prevents Needed Reconstruction of Bridges and Standardization of Highways

Cost of Road Upkeep High in District V

By LESTER H. GIBSON, District Engineer

ALL of the area in the counties of San Benito, Monterey, San Luis Obispo and Santa Barbara is included in District V of the Division of Highways. The first two counties are located in that portion of the State designated as Northern California counties in the allocation of highway funds and the latter two counties are in the southern group.

The Coast Range is the main mountainous section within the district, and along the Salinas River is the most extensive of valley section. Several important secondary highways traverse the Coast Range, connecting the coast with the interior valleys. Other secondaries connect these interior valleys with the San Joaquin Valley.

The roads in District V are located through a terrain classified from mountainous and foothill to valley, marsh, shoreline and desert. There are no road locations through the high elevation rugged mountainous passes, with the attendant expensive snow removal, nor has there been to date the costly storm damage experienced elsewhere in the State. However, a large proportion of the primary and secondary mileage lies through and along the Coast Range mountains and foothills, in a very unstable geological structure subject to slides and slip outs. This results in heavy expenditures for slide removal and roadbed stabilization under maintenance as well as adding greatly to the initial construction costs by reason of the necessary preventive measures employed.

The problem of protecting the exposed section of highway along the Salinas River and its tributaries, while not acute at the present time, is likely to result in the necessity for major expenditures in the future. At numerous locations the river is progressively cutting through deep silt banks toward the highway indicating the necessity for future protection or diversion works, or possibly some relocation. No allowance for such work has been included in the estimate of cost included at the end of this article.

The main traffic artery in District V is El Camino Real (U. S. 101), which enters the district about 25 miles north of Salinas, follows south through the Salinas River Valley for a considerable distance, crosses the river five times, thence traverses the Santa Lucia mountains of the Coast Range at what is known as Cuesta Grade, and continues southerly, partly along inland valleys and partly adjacent to the coast line.

Another route which gives promise of carrying considerable tourist traffic is the one generally referred to as the Roosevelt Highway (State Sign Route No. 1). The portion between Carmel and San Simeon was completed in June, 1937, principally with convict labor. A large portion of the roadbed excavation between the above points is hewn out of precipitous cliffs following the shore line.

Exclusive of the mileage through incorporated cities, there are about 264 miles of primary and 782 miles of secondary road in District V. Adding the 44 miles within the 14 incorporated cities to the above makes a total of 1090 miles within



Top—Salinas River bridge, 18 feet wide, restricted. Monterey County. Center—Narrow undergrade crossing on curve, San Luis Obispo County. Bottom—Hazardous line and grade on U. S. 101.







Top—Narrow bridge restricted for speed and load on U. S. 101 south of San Luis Obispo. Center—Grade separation on "S" alignment over railroad at Oceano, with sharp curves, narrow road, and steep grades on Coast Highway south of Pismo Beach. Bottom—Narrow bridge, restricted for loading, on reverse curve alignment, over Old Creek, between Cayucos and Morro Beach, in San Luis Obispo County.

the district. The district's secondary roads include 464 miles which were added by legislative action during the 1933 session, at which time 6600 miles were added to the State Highway system throughout the State.

The following tabulation gives the segregation according to types of surface as well as the percentage of total mileage in the various types:

33 miles or 3% unimproved and unoiled earth and gravel roads.

163 miles or 15% oiled earth, inferior as to grade, alignment, width and drainage.

48 miles or 5% oiled earth roads on which resurfacing only is required.

40 miles or 4% graveled roads with light oiled surface.

381 miles or 35% intermediate type surfacing.

425 miles or 38% high type pavement.

Of the 425 miles shown as high type pavement, 175 miles or 41%, are narrow in width, only 4 and 5 inches in thickness, are deteriorating rapidly, and must be replaced soon. An additional 45 miles or 10% requires additional width to bring them up to present day needs.

A tabulation of district road mileage of more than two lanes follows:

Rural	In Municipalities
3 lanes—11.718 miles	3 lanes— 8.444 miles
4 lanes— 7.852 miles	4 lanes—12.588 miles
6 lanes— 0.392 miles	6 lanes— 5.773 miles

Divided Highway

4-lane—3.812 miles which includes 3.282 miles for Cuesta Grade on U. S. 101 in San Luis Obispo County, that will be opened to traffic in November of this year.

Recently published results of a State-wide traffic count taken on July 10 and 11 indicate an increase of traffic of 3.3% throughout the State over the count taken in 1937. In this tabulation it is interesting to note that of the nine routes which lie wholly or partially in District V, all but three show increases over 1937 ranging from 0.94% to 15.47% on both Sunday and Monday counts.

Top—Narrow underpass, timber bridge, restricted sight distance on U. S. 101 Coast Route in Santa Barbara County North of Guadalupe. Center—Winding road, blind curves, on State Route 33, Cambria-Famoso lateral east of Paso Robles. Bottom—Sharp reverse curves on narrow alignment approaching a narrow bridge crossing the Salinas River in San Luis Obispo County.







Recent oil development and the expansion of the great acreages of perishable food products are responsible for a large increase in the amount of truck traffic during the past two years. This factor is one which makes it increasingly important to reconstruct some of the older pavement, particularly on U. S. 101, which carries these products on long distance hauls to the metropolitan areas and ports of San Francisco and Los Angeles.

It is believed that traffic on main artery U. S. 101 will show a greater increase on the completion of the relocation of Cuesta Grade, just north of San Luis Obispo, which has been a deterrent to traffic because of the combination of heavy grade, poor alignment and restricted width. The climatic and scenic advantages of this Coast route between San Francisco and Los Angeles, especially through the summer months, should make it increasingly popular when the bottleneck at Cuesta is eliminated.

The Roosevelt Highway is gaining in popularity as a tourist route from Northern California to Southern California and it is believed that if and when funds are available for a proper surfacing the scenic beauties will draw a considerably heavier traffic. This highway at the present time has a very light oiled surface using only the natural roadbed material and there is a crying need for adequate surfacing.

Within District V there are 21,270 lineal feet or 4.0 miles of bridges on primary and 29,830 feet or 5.6 miles of bridges on secondary routes. There are 8040 feet, or about 32% on primary and 5750 feet or 19% on secondary routes, of existing bridges which are restricted as to load and/or speed limit because of their structural condition.

The major portion of the unsatisfactory bridge structures on the secondary roads were constructed by the counties and included with the county

(Continued on page 17)



Extensive deep trenching for rock filling in drainage system made necessary to insure stability of big fill on realignment in Santa Cruz Mountains.

Los Gatos-Santa Cruz Project

OVERCOMING numerous problems presented by a rugged terrain and complicated geological formations, engineers of the Division of Highways and road contractors, with three finished links of the project behind them, are making rapid progress toward completion as a whole of the Los Gatos-Santa Cruz Highway.

At the present time, grading is going forward at three points on the final section of this ultramodern highway between Inspiration Point in Santa Cruz County and Oaks Road in Santa Clara County, a mile and five-eighths southerly of Los Gatos.

This job will cost approximately $180,000 per mile and will entail the excavation and disposal into fills of an estimated 2,200,000 cubic yards of earth and rock in a distance of 6¼ miles.

The Division of Highways expects the project to be ready for dedication to public service about July 1, 1939.

This particular stretch of highway comprises one of the most heavily traveled recreational highways in California, connecting the densely populated San Francisco and Peninsula areas with the scenic attractions and playground facilities of the Santa Cruz and Monterey coast lines.

How increasingly advantageous it will be to the thousands of pleasure seekers who used the existing obsolete highway may be judged from the fact that the traveled distance between Los Gatos and Inspiration Point will be reduced nearly two miles. The number of curves will be decreased from 132 to 20; total curvature will be 1118 degrees instead of 7700 degrees, and the present 75-foot minimum radius of curves will be increased to 500 feet. The average surface width of the new highway will be 46 feet as compared to the 20-foot existing roadway.

Of the 132 curves on the present road, forty have a radius of one hundred feet or less. The elimination of these traffic hazards alone is believed by the Division of Highways engineers to fully justify the cost of the relocation now being made.

REALIGNMENT BEGUN IN 1932

The first contract for the realignment of the Los Gatos-Santa Cruz Highway was let in 1932 and called for a four-lane highway through the heavy mountain sections where curvature is naturally limited, and a three-lane construction through the valleys and flats where easier curvature alignment could be secured. Contracts for additional improvements have been continuously under way since 1932. An important link in the undertaking was completed last year with the opening to traffic of the Scotts Valley reconstruction at the Santa Cruz end.

The Los Gatos-Santa Cruz Highway crosses over the ridge of the Santa Cruz Mountain spur of the Coast Range, which is the boundary between Santa Clara and Santa Cruz

counties. The hill slopes vary from moderate to steep, with general incline about 1200 feet per mile normal to the valley axis. From the standpoint of engineers and contractors the project presented many difficult problems.

The region through which the highway runs represents a series of geological periods and is structurally complex. About 1½ miles south of Los Gatos, a vast ridge or dyke of basaltic lavas cross cuts the country for miles in a northwest and southeast direction and is itself cut through by the erosion valley of Los Gatos Creek. At least two parallel major fault planes are crossed.

EXTENSIVE SOIL STUDY IS MADE

Surface conditions preclude the possibility of accurate determination of stratigraphic patterns in any continuous sequence; and generally, the decomposed top soils are in depths exceeding 20 feet. The dominant materials are shales and soft sandstones. In some locations, they are decomposed to known depths of 60 feet.

Extensive soil investigations were made by the Highway Research and Laboratory personnel of the Division of Highways before the present route was finally determined. Intensive subsurface studies of soil and geological formations were made at doubtful locations.

The value of this work both from a stability and future maintenance expense standpoint, can not be underestimated. In some cases it was possible to avoid areas of a dangerous character, as a result of the investigations; and in others, due to the knowledge gained of the underlying conditions, it was possible to design control measures to be installed during the construction procedure which we have every reason to believe will prove adequate.

BRIDGE PLAN IMPRACTICABLE

Many obstacles had to be overcome in the location of this highway. As an instance of this, it had originally been planned to cross Moody Gulch with a bridge. This gulch has been eroded out to considerable depth and bisects any logical location through this area, thus necessitating a crossing. An investigation of the foundation conditions disclosed the impracticability of designing an economical bridge at this location, and the entire location plan had to be



Mountainous area and geologic conditions of Los Gatos-Santa Cruz realignment present many fill and drainage problems. Picture shows clearing operations for large fill across deep ravine on new route which crosses line of existing highway seen near top of photograph.



Heavy reinforced concrete arch culverts are constructed under high fills where required water way is over 7 square feet. One such culvert as built under an old arch bridge is shown above. Both will be buried in the fill at that point on new route.

revised to provide the development of a line down into Moody Gulch to a point where its crossing by means of a deep fill would be possible.

The same foundation conditions which prevented the adoption of this bridge plan made necessary extensive control measures to insure the stability of this fill, but even this, added to the additional amount of distance necessary for development down into the gulch to make the required crossing, was many thousands of dollars cheaper than the most economical bridge design possible under the circumstances.

The territory through which this location passes has been highly developed with many subdivisions and improvements, with cabins, cottages and similar recreational improvements. Careful location was necessary to reduce to a minimum the conflicts with improvements of this nature and yet not sacrifice alignment or grade. A number of important recreational roads were crossed, where it was necessary to provide safe intersections. In one case of an important road of this nature, an overpass was designed to eliminate any possibility of future accidents.

The present road, which was graded in 1915 and paved in 1922, is a 15 to 17 foot by 4½ inch, Portland cement concrete surface flanked by 1½ foot of 4 inch oil treated shoulders. The shoulder surfacing was added in 1929, 1930, 1931. The new highway will provide four lanes for traffic—two in each direction—with three-foot shoulders. Through one short radius curve of 500 feet at Moody Gulch, a center division strip will be provided.

SEEPAGE AND DRAINAGE PROBLEMS

Earth guard rails—mounds of earth built 1½ or 2 feet high on the fill shoulder edges—are being constructed on all fills. The top course of the subgrade will be selected roadway excavation topped with crusher run rock base and a wearing surface of bituminized crusher run base materials, roadmixed and compacted over the roadbed, shoulders, gutters, and roadside face of the guard rails.

Approximately 80,000 cubic yards of rock for trenching and fill treatment in Santa Clara County were secured from a quarry in the vicinity of Station 248 at the north end of the project. A total of 50,000 cubic yards of rock for similar use in Santa Cruz County was hauled a distance

(Continued on page 13)



Divided 4-lane highway on Coast Route with curbed and planted minimum dividing strip, dual type pavement with 12-foot interior and 11-foot exterior lanes.

Promoting Traffic Segregation

By FRED GRUMM, Engineer of Surveys and Plans

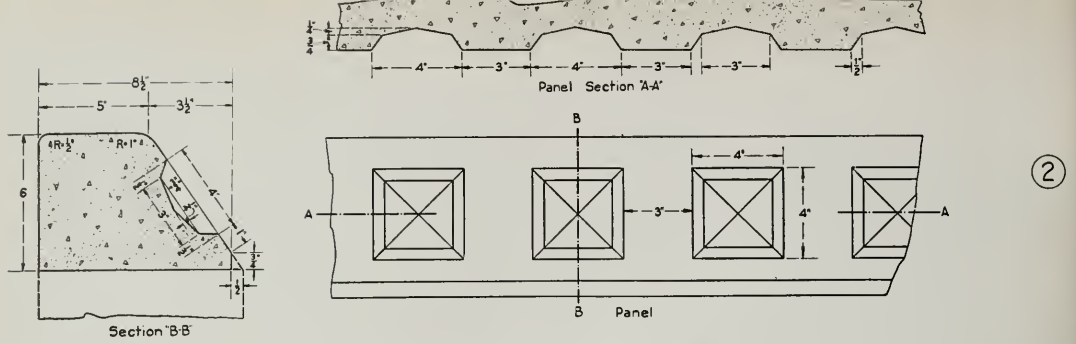
HIGHWAY ENGINEERS of the country are bringing to a point of general concurrence the results of their united effort to establish basic principles of highway design suitable for adoption under present-day requirements. The features of design to segregate paths of traffic in the interest of safety and comfortable operation, under the conditions of increasing speed tendencies and increasing volumes, have come under special attention. Changes in the highway for this purpose will probably be more apparent to the public than some other basic improvements such as in alignment and grade, which have been taking place more gradually.

In following the studies and reports on this subject it is natural to reflect on what part our own organization has taken in initiating design policies calculated to facilitate noninterference in safe travel on our highways, in supporting practices that conform with conclusions reached in authoritative engineering circles, and in planning and constructing as evidence of recognition of these present and future requirements.

Increasing pavement lane width is one of the elemental methods of assisting traffic segregation on the roadbed. About fifteen years ago the California state highway standard of ten-foot lane width was established. During the earlier years of this practice, the standard so established was generally adequate for the type of vehicle and speed encountered on highways at that time.

The provision for more adequate shoulders, (eight-foot width wherever practicable), became part of uniform design a few years later. With the treatment given the shoulders and with the flattening of side slopes, the efficiency of the pavement lanes was increased—a supplement to the effect of proper lane width. Results were appreciated by the traveling public, although the latter probably did not realize that for a long time it enjoyed a step in standards pioneered by but few other states.

This same enjoyment of ample roadway space led rapidly to the increase in rates of travel accompanied by steady increase in volume of traffic. Regardless of associated improvements in alignment and grade, traffic characteristics overreached the capability of ten-foot lanes to maintain sufficient segregation in respective lanes, especially with the introduction of larger amounts of the trucking element. As announced in the September, 1937, issue of "California Highways and Public Works," the State Highway Engineer put into effect an increase in width of pavement lanes. The eleven-foot width for pavement lanes was adopted as standard, with twelve feet for the passing lane where two or more lane widths are designated for each direction of travel. Incidentally, former practice was retained in specifying that minimum clear width on structures be two feet wider than each edge of uncurbed approach pavement. These standards, without further change, are complying with the recommendations now being promulgated for general practice by the American Association of State Highway Officials.



Recessed Curb Face for Curb Return or Island Section

Sketch of curb type with light reflecting panels.

Multi-Lane Highways

Extra lanes managed to provide for the further requirements of over-congestion on two-lane design during the period before high-speed tendencies and attendant accident rate brought conviction that the driver could not or would not move within safe limitations of conservatively designed facilities. Acceptance of assumption that the highway designer must extend his efforts to more fully counteract the harmful idiosyncrasies of the driver has, however presented additional problems. Their solution involves economic determinations as much as it does engineering technique.

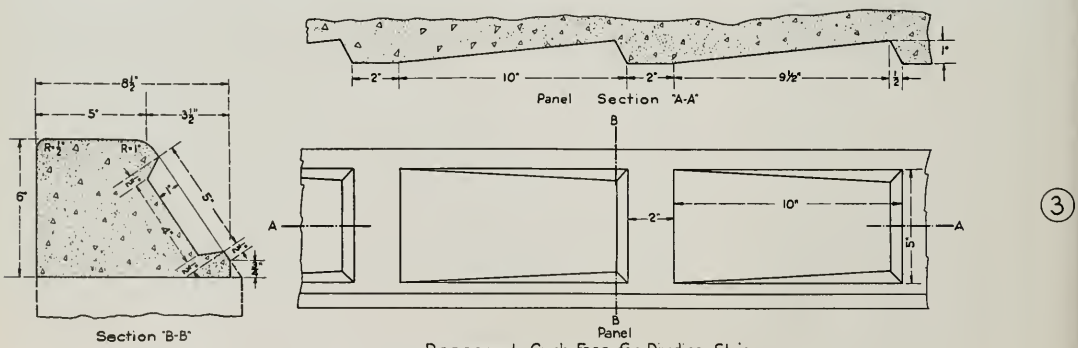
The three-lane highway design in California, is, for instance, a direct result of an effort to minimize outlay in providing for traffic volumes too dense for two lanes but not requiring four lanes. The three-lane road—which may be termed a divided two-lane highway—*more than doubles two-lane capacity and at reasonable cost.* It is adaptable to widening existing pavements and to new construction, whether or not there is expectation of later conversion to ultimate four-lane development. The potential hazard of cars operating on the middle lane limits its use to locations where safe passing sight distances obtain predominantly.

As now employed on California state highways, the three-lane design functions more safely and efficiently than the general public realizes. In California statistics the three-lane highways have a lower accident rate in side-swiping and head-on collisions than either two-lane or four-lane undivided highways.

Its efficiency in relieving congestion or readily segregating lines of traffic will be observed by anyone who has followed a heavily traveled two-lane pavement and sensed the immediate freedom of movement and dispersion of congestion as soon as the three-lane width is reached.

Proper three-lane design is not developed without careful study of future requirements, such as the ultimate conversion to four-lane divided roads. The economy in stage construction of three lanes is increased by selection of pavement types adaptable to greatest salvage value when the ultimate design is accomplished. Construction of two outside permanent pavement lanes with the central or less used passing lane having lower type surfacing gives the opportunity of converting the central lane into a dividing strip without appreciable loss when the permanent pavement lanes are symmetrically supplemented by two more lanes for a four-lane divided highway. Constructing the central lane of contrasting surface texture also serves an important purpose of defining respective lanes and of inducing use of the outer lanes except when passing.

Dividing highways of four or more lanes by neutral zones that separate opposing traffic movement is standard practice in this state. The design has been made a positive requirement with the undivided highway the exception that must in future proposals be justified by special conditions. We can not justify excessive outlay for dividing highways in limited speed zones where frequent crossings or intersections of city-street character re-



Recessed Curb Face for Dividing Strip

Sketch of curb type with light reflecting panels.



Divided 4-lane highway at Montecito with planted dividing strip and two parallel service roads separated from central roadway.

quire wide division strips for turning movements.

DIVIDED HIGHWAY PROJECTS

In the December, 1936, issue of this magazine, the divided highway problem in California was discussed at some length. We are reassured by subsequent progress that the policies indicated are still consistent with recommendations at large. Experience in our own state as well as elsewhere confirms the principles along which we have been working.

As more of the divided highway projects are undertaken, additional knowledge is gained of the many incidental items and considerations entering into correct construction. Collectively, they greatly increase the costs and difficulties of a divided highway program. We started our program on a conservative basis, anticipating the possibility of such adjustments. Although the divided highway program may now be considered in full swing it can proceed only as fast as the public can provide funds.

Granted sufficient funds, the Division of Highways can design and construct on any desired stretch a divided highway which would fully comply with current concepts. First there must, however, be adequate right of way. Reluctantly it is admitted that some of our projects, conservatively designed, have cost as much for right of way as for construction items. The division strip should be wide enough to properly treat intersections and cross-overs as well as to effectually divorce traffic streams from physical interference.

PLANTED DIVISION STRIPS

The division strip must be curbed or planted or treated to define and maintain respective roadways. In the localities where divided highways are most essential the maintenance of planting is often prohibitive, always a large perpetual expense. Structures must be proportionately increased in size, an expense not only for major structures but for the smaller drainage openings. When these things, together with a pavement and shoulders on good alignment and grade, have accomplished a facility for fast traffic, then there needs be provision for safely handling crossroads and for serving adjacent property with ingress and egress.

There are now on the State highway system about 120 miles of divided highways either constructed or under construction with curbs, wide separations, or raised or marked center strips. Plans prepared for projects now budgeted will bring this total to about 145 miles.

Many other miles of recent initial construction have been laid out on special design that requires only the addition of lanes to convert them into divided roadways. Most of this has been done within the past few years. In general it is the result of planning for improvements of an advanced nature without disastrously straining limited resources. The attainments may not be individually impressive. In the aggregate they indicate that an encouraging proportion of the State highways qualifying for this type of treatment has already been given attention.

DIVIDED HIGHWAY FACTORS

The width of dividing strip for divided highways determines many factors in the composite design. It influences the ultimate right of way requirement, the grading width and structure sizes, the type of treatment that would be applied to the center strip and the practical extent of turning movements at center strip openings.

To meet future needs in every respect, dividing strips 30 feet wide or more are desirable. On most of the roads rating four-lane capacity and therefore divided design, this would be prohibitive in cost of right of way, and in other cases would be prohibitive in cost of grading and even in physical limitations of roadbed stability. For practical economy, compromise widths must be accepted or it would be impossible to entertain an extensive program of dividing multilane highways.



Channelized "Y" type intersection of Waldo approach highway to Golden Gate Bridge and Coast Route to Sausalito in Marin County.

A four-foot width has been adopted as the minimum for separation strips. Six-foot width is a preferable minimum, this width incidentally being procurable when one ten-foot lane of an existing pavement is occupied by the dividing strip, with two feet of each side of that lane constituting part of adjacent twelve-foot traffic lanes. Separation strips twenty feet wide offer moderate protection between the two roadways as an intermediate stop-zone for crossing traffic With this or greater widths bordering curbs are not necessarily required.

SIX INCH CURB DESIGN

Curbs along dividing strips of limited widths are a necessary provision. The adopted curb design is six inches in height with face sloped on a batter of four inches in that height. The State has also developed and used a recessed curb design with light-reflecting panels that increase visibility at night and in fog. Without a distinctive color scheme that shows height and breadth of a plain curbed strip, there have been instances of overrunning the curb at night in belief it was only a pavement stripe.

Trial has been given to rolled, raised dividing strips, flush division spaces paralleled by double stripes, and flush division strips with embossed arrows placed diagonally across the strip. The latter type was developed in our Los Angeles district, originated for roadways where many openings required by developed adjacent property would destroy the usefulness of a narrow curbed strip. The raised arrows are painted white and the strip is bordered by double traffic stripe. The type is effective under special conditions and is relatively inexpensive in its construction and maintenance.

SEPARATING DIVIDED STRIPS

In some locations advantage can be taken of the topography to separate the two roadways by means other than the more conventional curbed plan. Using an existing two-lane pavement for one-way traffic, the other roadway for travel in the opposite direction may be constructed only approximately parallel thereto and not necessarily on the same grade plane except at crossings.

The width separating the roadways will depend on local conditions and width of right of way that can be procured. The investment on the original road can be retained and even though it may have been deficient in sight distance while carrying traffic in both directions, it will usually be found to be adequate in that respect when used for one-way traffic. Existing tree rows can be preserved by including them within the division strip. In such cases trees should be not less than about 12 feet from edges of pavement. A considerable mileage of divided road has been built in California by this method.

In the construction of divided roadways savings have been made by designing the inside lanes, used by the lighter and faster vehicles, for intermediate types of surfacing or for somewhat less thickness of permanent pavement types. The contrast in surface appearance of the two lanes is also a benefit in defining the lanes of travel.

Freeways and Parkways

Although divided highways are steps in this direction, California has not yet by law established the "Freeway" principle for the highways of the State. The necessity for the application of this principle, however, is imperative if the integrity, capacity and purpose of the major traffic arteries, especially in urban territory, is to be preserved.

Abutting property in such areas is rapidly developed to business or

semi-business purposes. This type of improvement induces traffic, creates stopping, parking and conflicting movements of vehicles. The improvement of the highway invites such adjacent development. Uncontrolled access from abutting property so developed, the movements of vehicles and volume of traffic induced thereby, quickly reduces the efficiency and capacity of the road. It returns again to its pre-improvement status—a congested local-service road.

The current method of financing State highway construction, maintenance and operation is by a tax on the road user. Abutting property does not contribute to the improvement of the road. In fact, it is compensated fully—usually at high prices because of increased valuation—for the right of way on which the highway improvement is made. Equitable treatment would require either a contribution by abutting property, proportional to benefits received from the improvement or a curtailment of the infringement on or destruction of a facility designed for a definite and necessary purpose and paid for by the user of this facility.

TWO PRESENT METHODS

Two means are at present available under the laws of the State and have been exercised in preserving the utility of several of our major highways. One is the acquisition of access rights from abutting property, limiting such access to definite and designated locations. The other is the acquisition of sufficient additional width of right of way to permit the construction of service roads fronting the property but separating from the central through roadway.

Access to the central roadway is permitted, again, only at definitely designated points where conflict may be eliminated. The latter method has proved to be the more feasible where frontage rights of property have already been established.

A section of this type of highway has been built at the southerly approach of State Highway Route 2 to Santa Barbara. Additional projects in the Bay area and in the metropolitan area of Los Angeles are under way. The Arroyo Seco Parkway, State Highway Route 205 between Central Los Angeles and Pasadena, has been designed and is being constructed for some seven miles of its length as a freeway. It is a six-lane divided central roadway with separated service roads where required. All cross-traffic will be eliminated by grade separation structures. Inlets and outlets with acceleration and deceleration lanes are provided at major highway connections. Appropriate landscaping is being planned.

Highway intersections

Highway intersections are critical and potential points of hazard. They are also prime factors in the interruption of free flow of traffic and reduction of the efficiency of the road. These influences are emphasized with increased volume and speed of traffic. Adequate design for safety and efficiency of the highway must, therefore, necessarily include the highway intersection.

Separation of grades at intersections is the satisfactory and ultimate solution of this problem. But, again, the high cost of this method of treatment and limitation of funds, imposes a deferred program of this character.

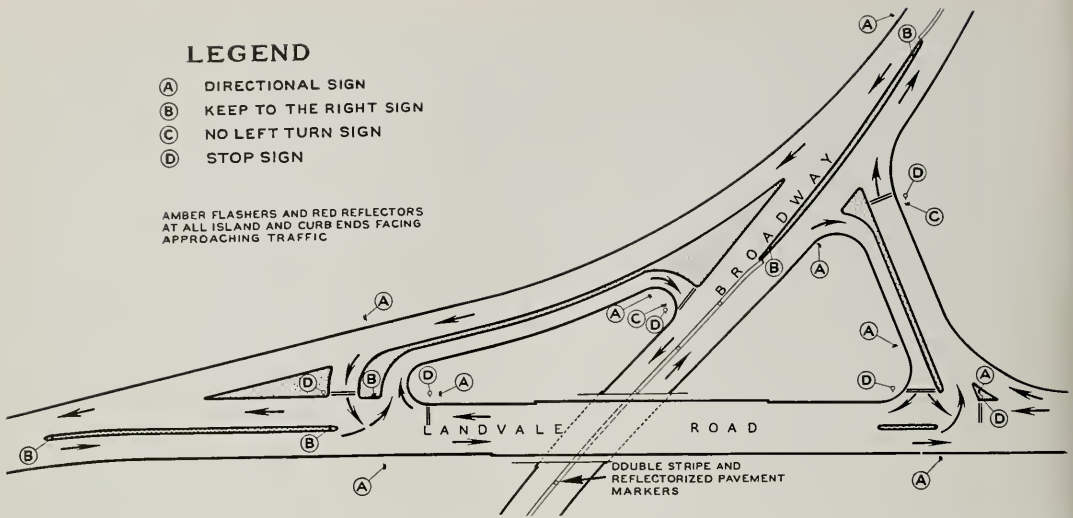
To meet this contingency, to provide some measure of protection pending the ultimate solution, to increase the capacity of the road without increasing the hazard at these central points, the construction of "channelized" intersections at grade has been included in the program of better standards for State highways.

This treatment also offers a more satisfactory solution than do customary methods of control for those intersections where moderate traffic volume on one or more of the intersecting roads does not justify separation but still requires relief from hazard and congestion.

The design of "channelized" intersections is based on the principle of segregating traffic into directional lanes. It is accomplished by the in-

Another view, looking north, of channelized "Y" intersection of Coast Route to Sausalito and Waldo approach to Golden Gate Bridge.





Plan of traffic channelization and separated grade intersection of two heavy traffic highways where only partial clover leaf connections are possible.

stallation of traffic islands which define the lanes for the movement of vehicles in every desired direction. The design should be simple. The path which each vehicle approaching the intersection must take should be clearly and visibly defined so that it may be negotiated without hesitation.

INTERSECTION CHANNELIZATION

The Y type of intersection frequently presents a particularly hazardous situation especially where two heavy traffic roads in open country are involved. At such locations usually the area of conflict between different streams of traffic is large or extended. Wide paved surfaces unless defined, permit uncontrolled operation of vehicles adding to confusion. Proper design at such intersections will provide for uninterrupted flow of the major traffic streams and will subject only the minor streams to an intersecting crossing with stop control.

Several installations of this character have been made or are in the course of construction. The intersection of State Highway Route 1 with the main road out of Sausalito and the intersection of State Highway Routes 4 and 23 near Newhall Tunnel.

Usually sufficient right of way is acquired at the time of initial improvement to allow for ultimate development of separated grades.

Seldom, if ever, will the plan designed for one intersection be suitable for another site without revisions therein and conditions usually require a new design even though the type is similar. We are striving for simplicity in design, uniformity in the manner of directing traffic movements and avoidance of indirect leads that may be confusing.

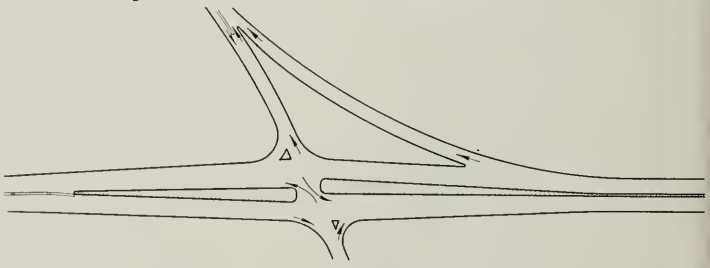
ADDITIONAL SAFETY FACTORS

Signing is an important factor in the intersection design. Preparation of the signing chart often discloses advisability of some revision in the design. The design is not complete without the traffic striping, reflector buttons, flashing lights and lighting.

Notwithstanding the assumption that the highway designer and constructor should do everything practicable to produce safe facilities, our economic set-up leaves no choice for him except to improve facilities progressively. By exercising ingenuity the engineer can economize but unless the design is also plainly understood and so utilized by the motorist the results are far from satisfactory.

Principles of separating highway lanes and of channelizing intersections are not universally understood by the motorist. With only a limited amount of construction of this nature in use it will take time to instill proper reaction to the new methods. When taught what to expect under these conditions the motorist will handle the facilities more efficiently and safely.

The motorist has not been given thorough instruction in the elemental principles of the highway design and as a result the engineer finds it difficult to provide foolproof facilities at reasonable cost.



Sketch of channelized intersection between heavy traffic highway and low traffic road.



Heavy grading work under way on Los Gatos-Santa Cruz realignment. Approximately 2,300,000 cubic yards of dirt will be moved.

Los Gatos-Santa Cruz Project

(Continued from page 6)

of 8 miles from Scotts Valley for foundation protection of fills.

Seepage and drainage had to be given special study. The average rainfall in this section is about forty inches annually, of which 23 inches are registered during the winter months. The maximum 24-hour rainfall is about 8 inches.

While the highway runs through mountainous region where there are no low level areas, there are stretches with soil mantle carrying heavy seepage. It is this condition that necessitated numerous construction precautions against seepage. Heavy gauge corrugated metal pipe culverts are used under high fills. The troublesome features of drainage are due to the spring and seepage areas caused by water impounded in the soil overlying stratas of shales and other dense materials.

Under high fills, heavy reinforced concrete arch culverts are being constructed on rock filled drainage foundations where the required waterway is more than 6 or 7 square feet. At one point on the present route, a reinforced concrete arch culvert has been built under an old arch bridge. Both the bridge structure and culvert will be completely buried in the fill at that point. Where a drainage area calls for a 24-inch circular area, a 30-inch diameter corrugated metal pipe is installed.

In addition to grading, excavating, and construction of fills and culverts, a job of no mean proportion is involved in the clearing of about 114 acres of redwood timber undergrowth and logged over sections of country. The cost of clearing along the right of way alone cost about $541 per acre.

Overhaul for the ordinary cut and fill balances is calculated at about 18,000,000 station yards. Along about 20 per cent of the line in the cuts the excavated material is suitable for fill up to subgrade elevation. On the balance of the route cuts and fills will have to be brought to a grade about 10 inches below subgrade elevation and suitable materials hauled in for topping. For practical purposes, calculations for balance and overhaul were made on the basis of rough grading to an elevation 1.35 feet below profile grade through the job. This allows 0.85 feet for select topping.

SEVERAL SLIDES ANTICIPATED

A swell factor of 5 per cent was applied to the whole excavation yardage. Through the forested areas top soil to a depth of several inches is full of forest litter and humus. In addition to the fill foundation trenching there is approximately 30,000 cubic yards of stripping of unsuitable material to use in heavy enbankments. The extensive sections of side hill filling also accumulate considerable loss to be covered by the shrinkage factor. On several locations excess clay is wasted on the upper side of gulch fills.

Several places in deep cuts are expected to fall or slide. This has been estimated at about 5 per cent of total excavation (about 100,000 cubic yards). An average overhaul of 15 stations is anticipated for slides, mak-

(Continued on page 28)

Galt Highway Realignment Eliminates 9 Curves on U. S. 99

By R. E. PIERCE, District Engineer

THE realignment of U. S. 99 in the vicinity of Galt has been completed and opened to traffic. This relocation eliminates the only poor alignment left on this important north and south highway between Sacramento and Stockton.

This improvement beginning on the present highway just north of the Southern Pacific Railroad, Ione branch, and crossing north of Galt, runs in a direct line southeasterly to a connection with the present highway at Jahant Corner on Cherokee Lane, 5 miles north of Lodi. The length of the new line is 4.98 miles, making a saving in distance of 0.57 mile over the present route.

The new line eliminates nine curves, ranging in radius from 368 feet to 3000 feet, having a total angle of over 371 degrees or more than one complete circle; while the new line has only two curves, one at each end of the change, with radii of 3000 and 5000 feet, and a total angle of less than 37 degrees.

The old bridge over Dry Creek is very narrow and with its curved approaches has long been a hazardous bottleneck. The new bridges, on the new location, of adequate width and with tangent approaches, will be appreciated by the traveling public. The Galt business district and the high school located on an "S" curve in the old highway are by-passed by the new line.

The grading and paving of this important improvement has been entirely completed, also the two bridges, built under a separate contract, over Dry Creek, construction of which was delayed by high water last winter.

As stated in a previous article, this project is planned for an ultimate two-way divided roadway, both as to right of way and location of the present pavement. This is accomplished in a right of way of 120 feet in width by placing the present pavement on an offset so that a 20-foot separation will be provided on the ultimately divided roadway.

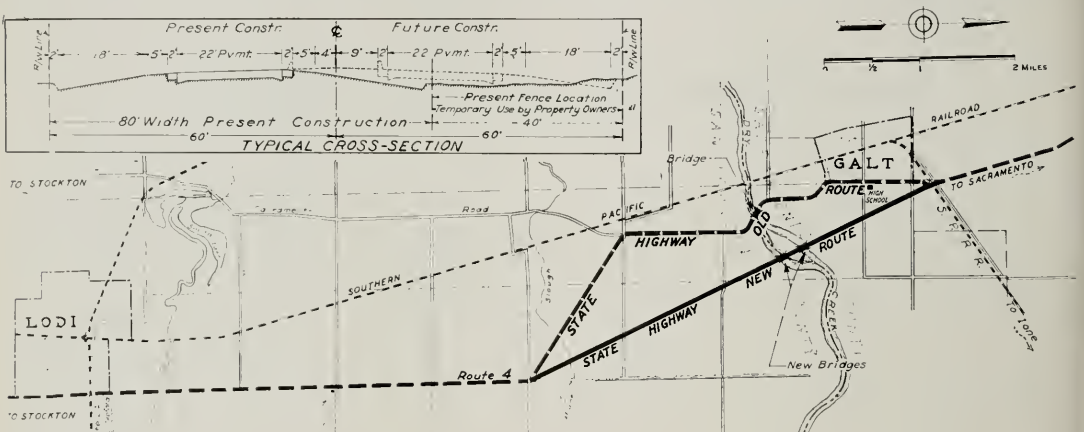
In order to avoid the appearance of an unbalanced right of way, the fences have been constructed so that the present pavement centers on an 80 foot strip on the westerly side of the right of way, the forty feet on the east being available for use by the adjacent property owners until such time as the highway is developed to its ultimate section.

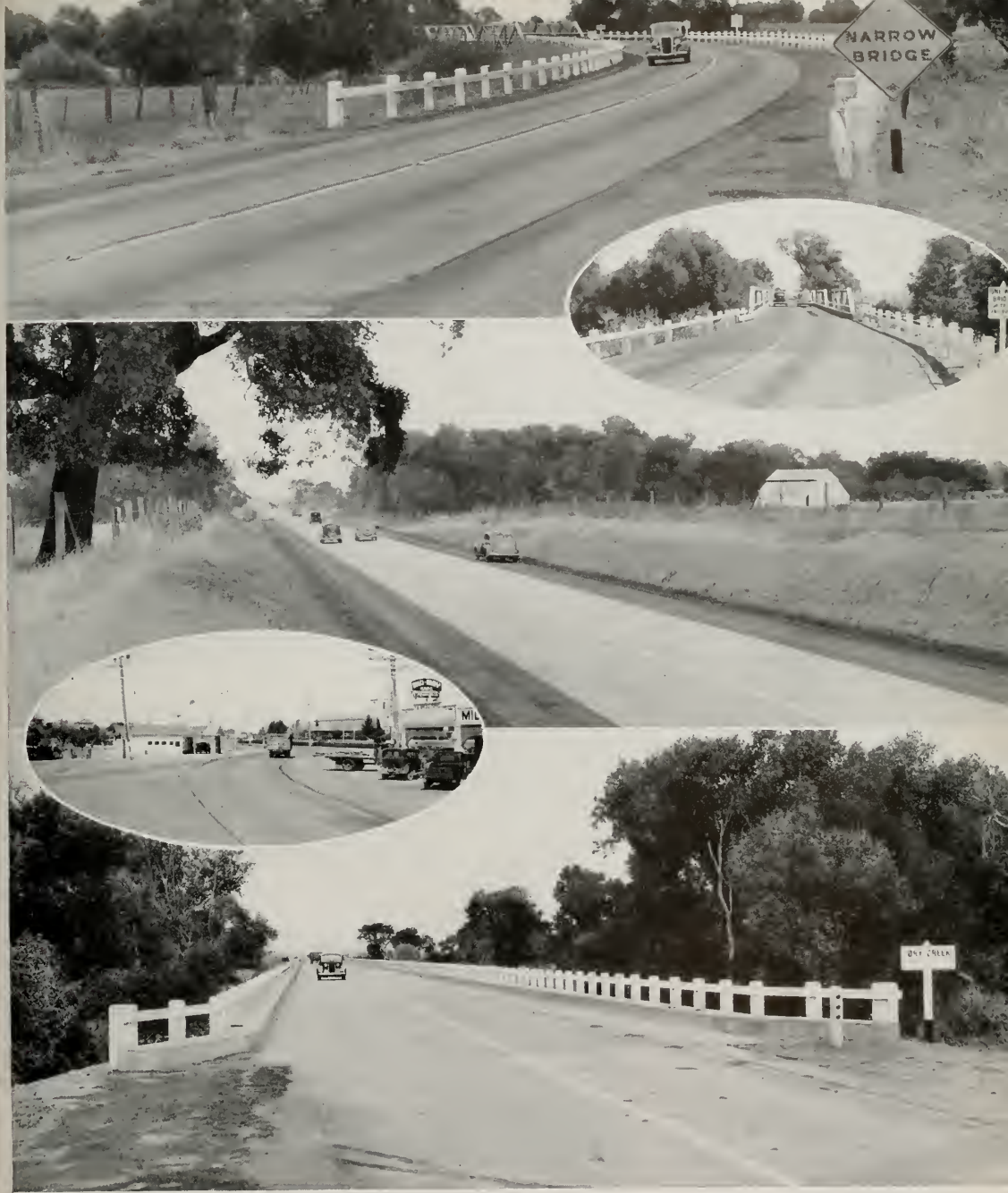
The grading in general is light. The adopted section called for finishing the subgrade 1.40 feet below the profile grade of the pavement and placing thereon a membrane seal consisting of 0.7 gallons per square yard of Grade "E" asphalt cement at a temperature of between 300° and 400° F. Upon this seal imported borrow was placed having a low shrinkage and high bearing and cementing values for greater stability.

The pavement placed in two strips, each 11 feet wide, was of class "B" Portland cement concrete; each strip was 0.55 foot thick upon the inside edge, to a point 2 feet from the outside where it increased uniformly to a thickness of 0.75 feet at the outside edge.

These two 11 foot sections are tied together by assemblies consisting of two ¾-inch round tie bolts, spaced four feet apart.

Expansion joints are spaced 60 feet apart with weakened plane joints 20





Features of the Galt realignment shown above are: Top and inset—Old, narrow Dry Creek bridge with curved approaches that constituted a traffic bottleneck. Center—Straight new 22-foot pavement with provision for four-lane divided highway. Inset shows old "S" curve through business section past high school. Bottom—New Dry Creek bridge.



New motorized mechanical float finisher. Front tank holds additional water supply.

feet apart. The usual dowels and supporting bars were used.

Featuring the concrete finishing work was the use of the new mechanical float finisher recently developed in Southern California. This mechanical float used here is the first motorized and improved unit to be placed on a major project. This machine works behind the tamping and levelling finishers, eliminating all hand float work except on joints and edges.

Several new developments have been incorporated in the suspension of floats and in the facilities for making adjustments of the floats. Motive power is supplied by a 60 h.p. engine, geared to a transverse drive shaft which transmits the power to a pair of wheels on each side of the machine. A water tank has been mounted at one end to provide additional water when it is required to form an even surface.

The mechanical float makes about six trips over the fresh concrete, following immediately behind the strike-off machine. Two mechanical tampers operate between the mechanical float and the paver, tamping and striking off the concrete.

On the first passes of the mechanical float the 8-inch roller is in contact with the surface, kneading the concrete and keeping the surface in an easily workable condition by bringing up fine portions of the mix. Meanwhile, the diagonal floats continually work the concrete back and forth from high to low spots.

On the final pass the roller is lifted and a cut-float at the rear of the machine lowered to the surface for the last strike-off. This procednre secnred a very true, smooth-riding surface.

The pavement was cnred by blanketing with heavy cotton mats, kept thoroughly wet for a period of seventy-two hours.

Between the two bridges across Dry Creek a fill about 500 feet long was built, protected by concrete slope paving on the ends and upstream face, and by broken concrete riprap on the lower face. Slope paving also protected the slopes at the other ends of the bridges.

The two bridges, the southerly one being 838 feet long and the northerly one 184 feet long, are of the slab type, placed on 3 pile bents; the piles were cast in place reinforced concrete in steel shells driven without mandrel.

On the grading and paving job Fredericksen and Westbrook were the contractors. A. K. Nulty was the resident engineer on the project for the State.

The contractor on the bridges was Lord and Bishop. Geo. W. Thompson handled the bridge contract.

This new location by shortening distances, by-passing the narrow business street in Galt and with much improved alignment, should materially increase the safety and comfort to the more than 4000 cars traveling this road daily.

Law Compels Careful Driving in Wet Weather

Reminding motorists that summer is gone and winter rains are upon us, J. W. Vickrey, Safety Engineer of the Division of Highways stated that last year 350 accidents on rural State highways were charged to slippery pavements.

"Highway engineers are building non-skid pavements and traffic protection features into roadways but they can not control rain, snow, and frost. Slippery pavements are only as safe as the motorist who drives upon them.

"Many people think the forty-five mile speed limit means they can travel at this speed at all times but the Vehicle Code provides that no person shall drive at a speed greater than is reasonable or prudent having due regard for traffic conditions and the surface and width of the highway."



Rear view of mechanical float showing details of controls. Engine is 60 H.P.



Narrow Bridge on Coast Route in Santa Barbara County that carries heavy truck traffic. Lack of funds prevents reconstruction.

Cost of Road Upkeep High in District V

(Continued from page 3)

roads which were taken into the State Highway system in 1933. They have been maintained in as serviceable condition as funds would permit, but should be replaced with new structures at as early a date as possible to obtain the fullest use of these roads. In addition to the bridges with limited capacity, there are other bridges which are entirely too narrow for the traffic which they bear and are a distinct hazard.

There are forty grade crossings in the district subject to elimination. Accidents have occurred at several of these crossings and the only reason that some of them have not been eliminated is because of lack of necessary funds. Some of the existing grade separations, particularly on the secondary system, are entirely inadequate and should be replaced with new construction so as to eliminate dangerous approach alignment and grades as well as to provide suitable structures. It is considered that 14 grade crossings should be eliminated as priority improvements in this district at an estimated cost of $1,011,000.

There are four existing grade separations which are inadequate and which it is estimated would cost $195,000 to replace with new structures.

There are some sections of District V highways on which the maintenance costs are unduly high. The cause of this expensive maintenance can be attributed to the fact that the road surface is not up to a standard required by the amount of traffic that the highway carries. This condition is entirely due to lack of funds for necessary construction and will continue until sufficient moneys are provided to bring the roads to the required standard.

An estimate of the cost of improving the highway system in this district to a proper standard for the traffic it bears is given in the tabulation below:

Of the total 1090 miles of State highways in the district 734 miles or 67% require expenditures as follows:

671 miles—2 lane: New and reconstruction	$22,435,000
19 miles—3 lane to 4 lane: Reconstruction	995,000
39 miles—2 and 3 lane to 4 lane divided: Reconstruction	3,241,000
5 miles—Bridges and Railroad Separation: New and Reconstruction	4,771,000
Total	$31,442,000

District V was allocated $1,874,000 in the previous biennium and $2,159,000 in the current biennium for construction and reconstruction projects. Assuming an average budget of $1,000,000 per year, it is evident that it will require 32 years to bring the highways in this district to a condition adequate for present traffic.

If traffic continues to increase as it has in the past, a considerable proportion of the improvements included in the estimate given above based on past allocations will be inadequate long before the expiration of the 32 years required to finance them.

Governor Merriam Pilots First Train Across Bay Bridge

WEARING a brand-new trainman's cap, Governor Frank F. Merriam, chairman of the California Toll Bridge Authority, piloted the first electric train across the San Francisco-Oakland Bay Bridge Friday morning, September 23.

A Key System two-unit streamliner, the train started at 40th and Hollis Street and proceeded to the easterly foot of the bridge, where Governor Merriam boarded with his party. The Governor was accompanied by Chief Engineer C. H. Purcell, Bridge Engineer Charles E. Andrew, Engineer of Design Glenn B. Woodruff, Florence M. McAuliffe and Lloyd W. Dinkelspiel, counsel for the California Toll Bridge Authority.

Railroad officials, who, with newspapermen, were other occupants of the train, included: W. A. Worthington; C. R. Harding; A. T. Mercier; L. B. McDonald, vice presidents of the Southern Pacific; W. H. Kirkbride, chief Engineer; E. E. Mayo, assistant chief engineer; G. E. Gaylord, superintendent; F. E. Sullivan, train master, and E. J. Foulds, attorney, all of the Southern Pacific.

Key System officials were Alfred J. Lundberg, president; vice presidents William P. St. Sure, C. N. Anderson, Chester C. Vargas, S. G. Culver, Bruce Campbell; Frank Richards, general counsel, Andrew T. Haas, architect. I. S. Shattuck, traffic engineer for the Golden Gate International Exposition was also an observer.

The Governor was originally scheduled only to start the train as a ceremonious gesture. However, after a few brief instructions by Vice President C. N. Anderson in charge of operations for the Key System, the State's chief executive proved himself an able trainman and remained at the controls to guide the train and its 80 some passengers across the bay—the first time in history that a train ever crossed under its own power directly between San Francisco and the East Bay.

The trip proved the success of the bridge railroad constructed by the State Department of Public Works. Unanimous opinion of railroad experts and newspapermen was that the roadbed provided smooth and quiet operation; that the automatic cab control system was highly efficient and that the view from the train windows was unsurpassed.

Chief Engineer C. H. Purcell tersely summed up his inspection following the first test run. He reported: "The cab signal for the run indicated a permissible speed of 35 miles per hour and the train proceeded across the bridge in accordance with this prescribed signal indication. All facilities and equipment operated as intended."

It required approximately an hour to make the round trip over the bridge on the train's first run. This was due to frequent stops for inspection of expansion rails, and to permit newspapermen to photograph the train on the bridge.

It will require approximately 10 minutes after trains are in actual operation, to cross from the center of the San Francisco Bridge Terminal building to the easterly foot of the span.

Bay Bridge Traffic Shows Increase Over September 1937

A FIVE per cent increase in San Francisco-Oakland Bay Bridge traffic over that of a year ago was revealed yesterday by Director of Public Works Earl Lee Kelly from the September traffic report filed by State Highway Engineer C. H. Purcell. A total number of 740,622 vehicles crossed the bridge during last month, as compared to a total of 705,704 for the same period in 1937.

Due to changes in rate parities between the ferries and the bridge since the time of the bridge opening, this is the first time that a parallel comparison could be made between 1937 and 1938 and those for the current year. Other classifications of traffic also showed an increase over last year. Freight pounds were up 67 per cent, with a total of 107,886,750 pounds for September, 1938, as against 64,352,834 for the same month in the previous year. The number of trucks increased approximately 51 per cent with the comparitive figures of 37,684 for September, 1938, and 25,031 for September, 1937. Buses increased 39 per cent with 13,153 buses crossing the span last month and 9462 in September of last year. Traffic for September, 1938, averaged 24,687 vehicles a day—a drop of 389 vehicles from August.

High point of the month was on Saturday, September 24, when 33,762 vehicles crossed the bridge. This increase was due to the St. Mary's football game in Berkeley.

	Total September	*Total August*	*Total since opening*
Auto Trailers	1,473	1,848	27,772
Passenger Autos	657,611	693,297	15,571,167
Motorcycles	2,806	2,994	58,396
Tricars	1,003	1,167	18,293
Buses	13,153	13,432	207,185
Trucks	37,684	39,863	600,912
Truck Trailers	1,637	1,768	34,576
Toll Vehicles	715,367	754,369	16,518,301
Auto Passes	23,245	21,089	231,345
Truck Passes	2,010	1,905	22,315
Total Vehicles	740,622	777,363	16,771,961
Extra Passengers	233,561	244,728	4,027,469
Freight Pounds	107,886,750	111,016,500	1,482,654,409





After a few minutes of instruction, Governor Frank F. Merriam took over the controls, started the motor, and piloted across the San Francisco-Oakland Bay Bridge the first train in history to cross under its own power from Oakland to San Francisco. The Key System two-unit stream line is shown with Governor Merriam at the throttle and below, shaking hands with the Governor are railroad workers: (left to right) Martin Coyne, John Armstead and Fred Welsh.

A Graphic Presentation of the Traffic Safety Problem

By C. H. PURCELL, State Highway Engineer

TRAFFIC Safety in the broad sense in which it must be treated by the Division of Highways signifies the safe and orderly movement of traffic over an entire highway system—operating within its income.

While profoundly concerned that such movement shall be safeguarded against personal hazard to all engaged in it, frank recognition must be made of the fact that "safety" is a relative term and when combined with "traffic" the subject immediately becomes greatly complicated. This problem in solution calls for the practical adjustment of the several elements, which rightfully demand full consideration before a decision is made.

Any highway system is perfectly safe when there is no traffic, and likewise perfectly useless. Once traffic is introduced the highway system is never again perfectly safe; but, fortunately, we know that increased use does not necessarily bring relatively increased hazard. It is this knowledge that gives reasonableness to the effort that is being constantly put forth to increase the usefulness to traffic of the highway system and at the same time to lessen the hazard of accident.

The ultimate in traffic facilities so far as each individual is concerned would provide complete freedom of movement; a condition, of course, unattainable because of the conflict of interests among the millions of individuals who must be accommodated on the system. Nevertheless, because the highway system becomes more nearly satisfactory to traffic as freedom of movement with safety is assured, the promotion of traffic safety must be of a positive nature primarily, and negative only to the extent that adequate control demands such measures.

In its broader aspects traffic safety comprises many other things of importance in addition to relative freedom from danger to life and limb. Safety also means security, dependability. Complete interruption of traffic would eliminate all collisions between vehicles, but this interruption would in itself greatly damage traffic as such and could lead directly to great personal suffering.

The weakening or collapse of the highway system in any of its portions or its essential functions could be just as definitely disastrous to the safe and orderly movement of traffic as the failure through inadequate design, construction, or maintenance of any particular physical part.

In order that the maximum in traffic safety may be obtained from each highway dollar expended, those responsible for decision as to its use must have before them understandable data covering those basic conditions which will in general govern any final conclusions.

The main factors that will ordinarily weigh most heavily are:

1. **The traffic served.**
2. **The service given.**
3. **The cost of service.**

Accurate knowledge of these three factors is vitally essential, not alone for the proper and equitable allocation of maintenance and improvement funds but for protecting the very solvency of the system itself.

This information, to be of practical use, must be neither so general as to prevent the review of each administrative unit by section or route, nor yet so detailed that the major features are lost in the mass of lesser items.

In making such a statement there is no intention to convey the idea that a general knowledge of these three items alone is sufficient equipment for the successful operation of a highway transportation system. It is simply to emphasize the fact that reliable information on these major points must always be immediately available to give or deny support to proposals based upon other factors purely local or more specific in character, and to make possible the orderly pursuit of proper and far reaching policies.

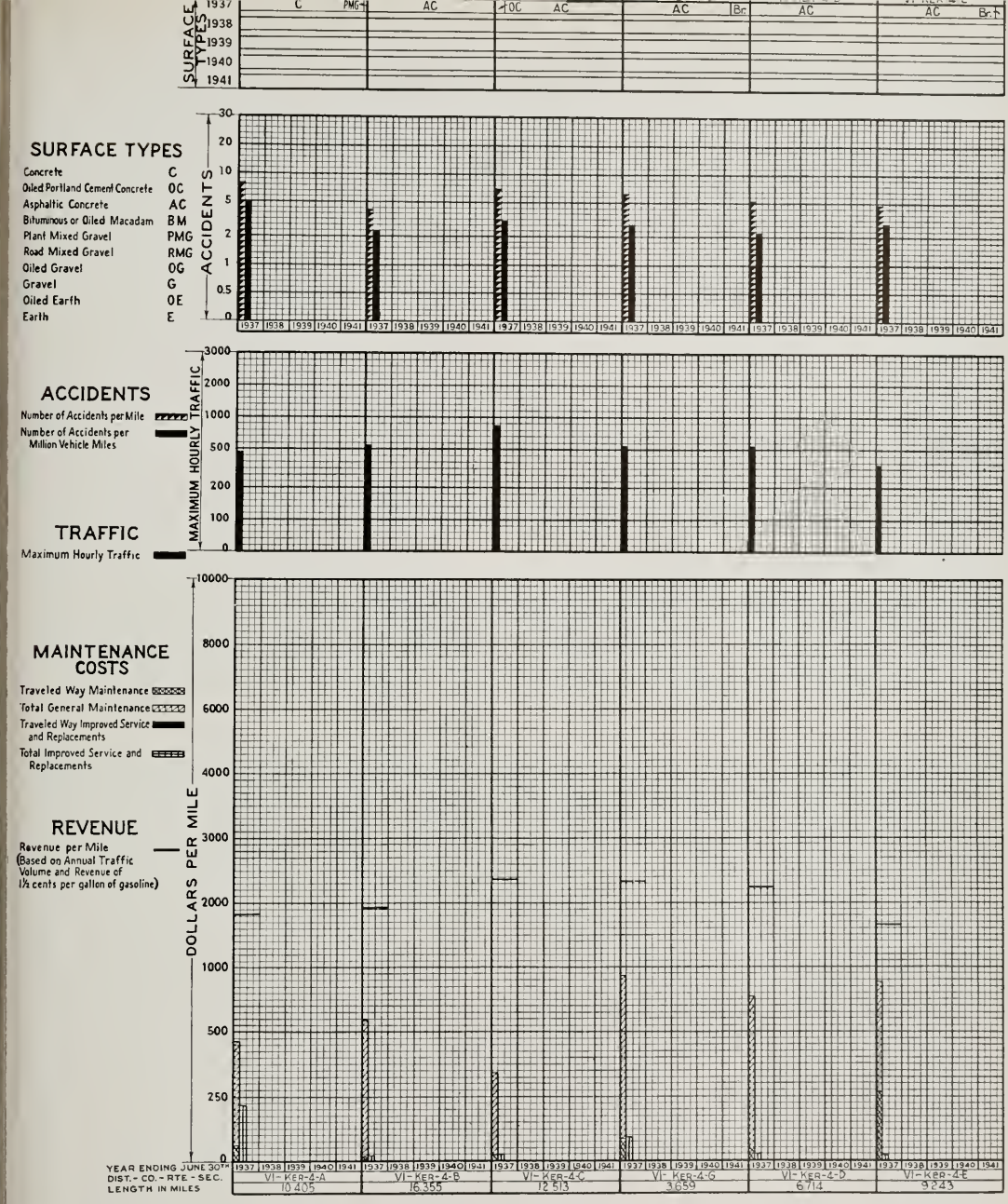
The type of chart shown on the adjoining page is an endeavor to graphically present these major factors in a convenient and usable manner. It covers portions of Route 4 (Golden State Highway) in Kern County.

Charts have been made covering the entire State highway system, showing each legislative route by individual administrative sections in order of occurrence along the route from beginning to end, with spaces provided for comparative showing of the various factors over a five-year period.

The traffic involved is indicated both as to total vehicle mileage for the entire year and the peak-hour traffic as disclosed during the annual summer traffic census. The total yearly traffic indication is contained in the line showing "revenue per mile," since one is a derivative of the other, each dollar of revenue representing roughly one thousand vehicle miles of travel.

The service rendered in terms of safe and orderly flow of traffic may be judged by reviewing the traffic accident rates in terms of concentration per mile of highway and in terms of actual hazard per million vehicle miles of travel. In addition, the class of service that is being provided for traffic at any point may be considered from the basis of both total and peak-hour volume with relation to the known lane width of any section or route, and the type of surfacing on the traveled way.

The cost of service rendered to traffic during any year under consideration is shown in terms of expenditures for both General Maintenance and Improved Service and Replacements. It will be noted that no attempt has been made to indicate service costs that might be chargeable to original and subsequent permanent investment. Any comparison on this



basis would necessarily be manifestly inequitable to traffic in many respects.

In common with all similar graphic aids, this remains simply an aid and presupposes always that those called upon to make use of it will have at their command the vitally necessary intimate knowledge of specific conditions, which can never be reduced to a point on a chart. Used in this manner, it can be of real assistance in facilitating the review of the many traffic safety problems which are constantly being faced by those responsible for their solution.

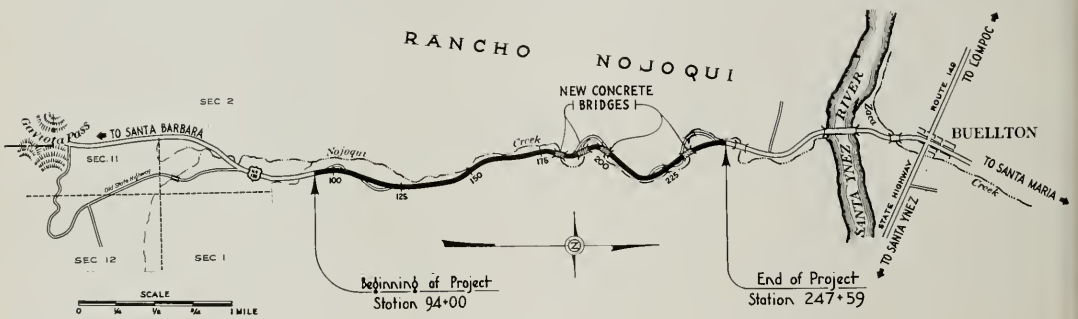
Realignment of Coast Route in Nojoqui Canyon Under Way

By J. C. ADAMS, Resident Engineer

FOR many years there has been a comparatively short section of State highway, U. S. 101, south of Buellton in Santa Barbara County, which has been badly in need of reconstruction. This need has been particularly evident since the reconstruction of the Nojoqui Grade over the Gaviota Pass immediately south of the Buellton section about three years ago. The increased speed possible on the new Nojoqui Grade as compared with the old highway made the sharp curves and reversals in alignment on the Buellton section doubly hazardous and the need for this improvement was also emphasized by the fact that the highway being studded with live oaks and various native shrubs, but the point of greatest beauty is about midway of the job near a private enterprise that utilizes the heavily wooded section for camp and picnic grounds. Considerable study was given this particular location so as to preserve the trees and natural beauties.

Landscape engineers and architects studied the proposed location in considerable detail with the result that the landscape suffered a minimum of damage.

Particular attention was paid to preservation of trees and other scenic attractions along the creek. Every tree was located upon a map and the final line was not selected until after intensive study in both field and office. As has happened in other relocations it is believed that this project will present greater scenic values after completion than does the present route and without sacrifice to the standard of construction. Two of the four bridges were planned in order to prevent the unsightly scars which would have resulted from otherwise necessary channel changes.



north of this section is on comparatively good alignment.

The Buellton section joins the northerly end of the Nojoqui Grade and extends northerly for 2.9 miles to connect with a former reconstruction about one mile south of the Santa Ynez River. The only logical location for the new alignment was down the more or less narrow Nojoqui Creek Canyon, and in order to bring the alignment up to a proper standard it was necessary to cross Nojoqui Creek with four bridges on account of the very winding course of that stream.

This section of the Nojoqui Creek Canyon is very scenic, the slopes

NINETEEN CURVES ELIMINATED

The new highway decreases the number of curves by 19 and the total delta from 907 degrees to 479 degrees. The number of curves of 700-foot radius or less is decreased from 21 to 0 and those of 1000-foot radius or less from 28 to 5.

The minimum sight distance on vertical curves has been increased from 340 feet to 825 feet, and the maximum grade of the new road is 4 per cent as compared with 6.19 per cent of the old.

To conform with present standards of alignment it was necessary to construct the new roadbed on portions of the Nojoqui Creek channel which compelled channel changes. Fill slopes adjacent to the channel changes are protected by selected rocky material from the cuts.

The center 22 feet will be paved with Portland cement concrete pavement 0.75 foot thick at the edges and 0.55 foot thick for the central 18 feet.

Supporting the pavement will be selected imported river borrow material with a minimum thickness of 6 inches and extending 1½ feet beyond the pavement edges.

Additional protection to the subgrade and pavement will be afforded by a Grade "E" seal of asphaltic membrane spread on the subbase.

Roadmixed oil shoulders of imported select river material and liquid asphalt, SC-2, and oil-mixed berms complete the roadway finish.

Anticipating heavy through traffic



These pictures show two bridge operations through the oak groves on Route 2 near Buellton where every care is being taken to preserve the trees and the natural scenic beauty of that section





New highway sector in Nojoqui Valley with gradual grade and easier curves cuts out many sharp turns and shortens distance.

and heavy trucking of produce from the local Santa Ynez and Lompoc farming districts, a system of detours was designed and included in the contract. The detours are surfaced 20 feet wide of oil-mixed river gravel. Connections from the detours to the existing portions of present road provide a two-way passageway for the convenience of traffic outside the limits of construction.

TRAFFIC DETOURS SEPARATED

The idea of separated detour traffic was followed throughout the length of the project with the exception of a short section at La Vega Park where a permanent scar to the landscape would have resulted by reason of detour construction. The hills in this section are covered with oak trees.

The construction of four reinforced concrete bridges was included in the general contract. Two of these bridges replace existing structures across Nojoqui Creek and the other two are located at La Vega Park where the new alignment eliminates a dangerous "S" curve on the old road.

Conforming to roadside improvement standards all oak trees outside limits of traveled way but inside side slope areas were saved. Wells were constructed around the trunks of the trees with native rock to protect the tree roots from suffocation.

Cut and fill slopes are to be covered with a seed cover of local top soil to promote the growth of vegetation. California poppy seed will be added with the top soil cover in an attempt to start a growth of these native perennials on the new slopes.

The Contractor, C. O. Sparks and Mundo Engineering Company, started operations in May of this year. The excavation yardage has been handled mostly with 13-cubic yard tractor-drawn carryalls and rooters. The grade work is approximately 85 per cent complete and paving operations will start during the first week in October. It is anticipated that the entire work will be completed by Christmas of this year.

The project is being financed from gas tax funds set up in the current budget for this biennium.

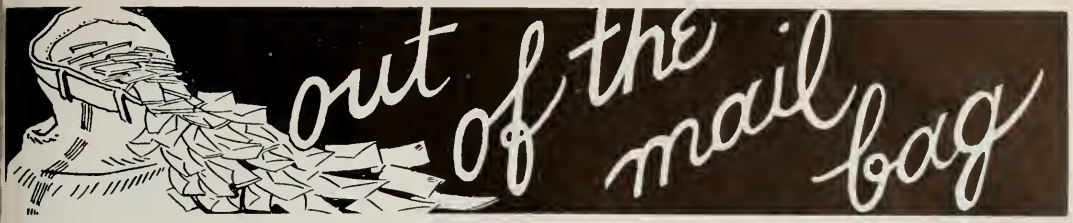
300 Billion Miles of Auto Travel Predicted for 1938

AMERICA probably will drive motor vehicles to a new record of 300 billion miles in 1938, according to Dr. L. I. Hewes, Deputy Chief Engineer, Bureau of Public Roads.

There are many interesting facts about highway transportation which Dr. Hewes thinks people in general should know.

For example, he says they should know that "the use of highways has increased about 73 per cent in 10 years, that many city street patterns are outmoded, and that traffic in the larger metropolitan areas of this country is becoming a dominant problem. They should know that in 1937 we had 4,255,296 motor trucks, with a total of about 7,200,000 rated tons capacity and that this tonnage capacity increased 20 per cent in the three preceding years, and now compares with about 105,000,000 tons of existing freight car capacity.

"It should be understood," he adds, "that city delivery and farm-use trucks are not directly competitive with railroad freight business; that, nevertheless, certain farm-to-market trucking such as for milk, live stock and eggs, is taking railroad freight business; that where origin-and-destination handling of any freight is important, truck use will continue to increase, but that truck use is conditioned by road congestion, and helps cause it; that increasingly more financial responsibility will be required of commercial truck operators such that ultimately, progressively higher licensing fees for trucks will carry along legitimate demands from owners for better truck-service roads, and especially for easier grades."



Pacific Electric Railway Company

Los Angeles, Calif.

Editor California Highways
and Public Works,
Sacramento, California.

Dear Sir:

Should greatly appreciate your placing my name on the mailing list of "California Highways and Public Works" so I may receive this valuable publication regularly.

I find the well prepared articles highly informative and educational, and wish to compliment your staff on maintaining such a high standard of constructive journalism.

Thanking you in advance, I am

Yours very truly,

L. H. APPEL,
Research Engineer,
Pacific Electric Railway.

Mack International Motor Truck Corporation

Sacramento

California Highways
and Public Works,
Sacramento, California.

Gentlemen:

Mr. C. G. Price, Mgr. California Door Company, Diamond Springs, California, requests that his name be placed on your mailing list to receive publications of "California Highways and Public Works." * * *

We are receiving the publication at this office and want to compliment you upon the very constructive work that you are doing.

Very truly yours,

W. V. MORGAN,
Mack International Motor Truck Corp.

University of Idaho

Moscow

Editor California Highways
and Public Works,
Sacramento, California.

Dear Sir:

We are writing to thank you for your courtesy in placing the University of Idaho Library on your mailing list to receive "California Highways and Public Works." We are very glad to receive it.

Very truly yours,

AGNES PETERSON,
Reference Librarian.

San Francisco, Calif.

California Highways
and Public Works,
Sacramento, California.

Gentlemen:

While visiting my brother, Jack F. Silver, manager of the Martinez office of the California State Automobile Association, I noticed the September issue of "California Highways and Public Works."

This publication is the most interesting one I have seen, and I will appreciate it if you will place my name on your mailing list.

Thanking you for your attention in this matter, I am

Yours very truly,

GEO. J. SIVERS,
1850 Jefferson Street,
San Francisco, California.

Revue Generale Des Transports

par

Air, Eau, Terre

23 Rue des Mathurins, Paris 8e.

Messrs. C. H. Purcell
and T. H. Dennis, Engineers,
Department of Public Works,
Sacramento, U. S. A.

Gentlemen:

We have the honor to acknowledge receipt of your letter of the 17th of August last, sending us illustrated articles for which we thank you.

Will you oblige us by accepting a regular exchange of your publication, "California Highways and Public Works," for our magazine "La Revue Generale des Transports?" If so, please send us issues of the months of July and August.

The same mail will bring you the July and August issues of our publication.

With our thanks we beg you, gentlemen, to accept our kindest regards.

HENRI MACE,
Director-Editor-in-Chief.

Yale University Bureau for Street Traffic Research

New Haven, Conn.

Editor California Highways
and Public Works,
Sacramento, California.

Dear Sir:

On pages 8 and 9 of the June issue of the California Highway Magazine there is an excellent series of pictures dealing with the new construction of the Bakersfield Grapevine highway, copies of which our bureau is anxious to have for its visual aids library.

* * * * *

During the academic year examples of such construction are exceedingly helpful to our students, and we would appreciate it very much if we might obtain copies of these illustrations. Be assured that credit will be given for the use of these pictures.

Thanking you so very much, I am

Sincerely yours,

BRYANT BURKHARD,
Research Assistant.

University of California

Department of Economics,
Berkeley, California.

California Department
of Public Works,
Sacramento, California.

Gentlemen:

I shall be glad to be put on your mailing list to receive copies of your publication, "California Highways and Public Works."

The material will be used in connection with University instruction.

I am, yours truly,

STUART DAGGETT,
Professor of Transportation.

The Atchison, Topeka and Santa Fe Railway Company

Los Angeles, California,

California Highways and Public Works,
Sacramento,
California.

Gentlemen:

Occasionally in the past I have had the opportunity of reading your Official Journal, and I find the publication to be very interesting and enlightening.

I would like very much to receive a copy regularly, and after reading, I would like to file them for future reference.

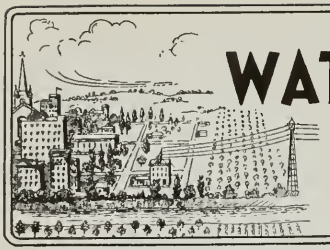
Thanking you in advance, I am

Yours truly,

(Signed) F. E. PAINTER,
Right of Way Agent,
The AT&SFRyCo.

Pedestrian (to passing motorist): "Hi, mister, I'm going your way."

Motorist: "So I see, but I'll get there before you do."



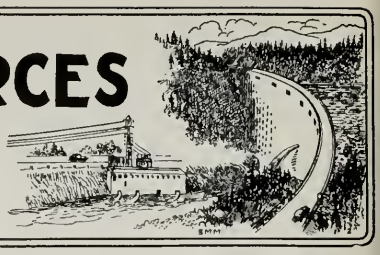
DIVISION OF WATER RESOURCES

OFFICIAL REPORT

FOR THE MONTH OF

September, 1938

EDWARD HYATT, State Engineer



FILING of applications for allotments from money appropriated to the Emergency Fund for the restoration of public property, levees, flood control works, county roads and bridges, damaged by floods of the 1937-38 winter season throughout the State, has continued. Investigations of these applications have been or are being made and 163 reports and recommendations have been prepared by the Division of Water Resources and State Reclamation Board and submitted to the Director of Finance. Governor Frank F. Merriam has approved allocations totalling $3,743,700 for flood damage repair work covered by these reports. The Division of Water Resources is performing some of the work for which these allocations were made and other work is being done by the applicants under contract entered into with the Department of Public Works.

Plans and specifications for all work being done under contract are checked and approved by the Division of Water Resources before work is commenced and all work supervised and inspected by representatives of the division. There are now in force 105 contracts for work which will cost $2,955,000. Several projects have been completed but most of them are still under construction or ready for the beginning of construction.

SACRAMENTO-SAN JOAQUIN WATER SUPERVISION

The rice fields are rapidly being drained and in a few instances the harvesting of the crop is under way. Harvesting of sugar beets is in full swing. Some water is still being applied to beans. This season there was in excess of 100,000 acres of rice irrigated from the streams and returned flow channels in the Sacramento Valley. In the same area there were irrigated also about 240,000 acres of general crops.

The flow of the Sacramento River at Sacramento is gradually increasing and by the end of this month will show a marked increase in flow. The lowest flow in the Sacramento River occurred near the end of August when the discharge dropped to about 4200 cubic feet per second. The flow of September 24th was about 6700 cubic feet per second. The flow of the San Joaquin River near the end of August was 2500 cubic feet per second and on September 24th was about 2200 cubic feet per second.

IRRIGATION DISTRICTS

Merced Irrigation District has requested approval of a project involving the concrete lining of eleven miles of main canal and the replacement of necessary bridges, structures and gates along the sections improved. The estimated cost of the work is $105,858. It will be financed by a grant of $47,636 from P. W. A. and the expenditure of $58,222 from district funds derived from power revenue. Only a small percentage of the 1200 miles of canals within the district have been concrete lined, but this improvement will be carried on as funds for the purpose are made available.

SUPERVISION OF DAMS

In view of the large amount of carry-over storage that will exist this season every effort is being made to put all dam structures into such an operating condition that excessive run-off may be cared for.

Construction is being actively pursued on North Fork, Suttenfield, Charles Lee Tilden Park and Mad River Dams in order that they may be completed before the coming winter season.

WATER RIGHTS

Forty-two applications to appropriate were received during August; 4 applications were denied and 23 were approved. In the same period 4 permits were revoked and rights were confirmed under 4 permits by the issuance of licenses. Inspections preliminary to the issuance of license or revocation of permits were made during the past month in the Sacramento Valley.

COOPERATIVE FLOOD CONTROL

The Division of Water Resources has continued studies in cooperation with the U. S. Departments of War and Agriculture for the formulation of a coordinated statewide plan of flood control for the State of California. Conferences between state agencies have been arranged in order to work out a program for the harmonization of the plans of the interested agencies.

FLOOD CONTROL AND RECLAMATION

Routine maintenance on the flood control project has been carried on during this period, in preparation for high water this winter.

Application has been made for a P. W. A. grant of approximately $80,000 for project maintenance repair work on the Sacramento flood control project, under which a total of $182,000 will be spent if the application is granted. This work includes cleaning and improving canals, construction of bridges in the by-pass, repairing wave wash damage on the east levee of the Sutter By-pass, gravelling roads on top of levees, and repair of incidental flood damage.

Relief Labor Work

An average of 85 relief laborers have been employed in cleaning in the Feather River overflow channel during this period. Beginning in one week, 50 additional laborers will be employed in the Sutter By-pass from the S. R. A. transient camp in Sutter Basin.

Approval is expected of a W. P. A. application which was made to cover flood control work in District No. 2, containing the valley counties from the Delta north to Trinity County. This will permit the clearing of numerous flood channels.

Russian River Projects

Plans are under way for additional work on the Russian River Jetty with funds contributed by the Fish and Game Commission, County of Sonoma and County of Mendocino, totalling $55,500. An application has been made for a P. W. A. grant of $45,000 which, if allowed, will permit an expenditure of $100,000.

CENTRAL VALLEY PROJECT

Engineering studies in connection with the Central Valley Project have been continued under a cooperative agreement with the U. S. Bureau of Reclamation, with the Division of Water Resources representing the Water Project Authority of the State of California.

Negotiations have been continued with the public utility companies for the relocation of power and communication facilities.

Highway Bids and Awards for the Month of September, 1938

CONTRA COSTA COUNTY—Two undergrade crossings to be constructed under the tracks of Sacramento Northern Railway and under a county road at Ohmer Station and about 0.15 mile of roadway to be paved with Portland cement concrete. District IV, Route 106, Section C. Union Paving Co., San Francisco, $44,461; D. W. Nicholson, Oakland, $45,714; R. G. Clifford, San Francisco, $47,173; Heafey-Moore Co. & Frederickson & Watson Construction Co., Oakland, $47,877; P. J. Walker Company, San Francisco, $47,942; E. T. Lesure, Oakland, $58,492. Contract awarded to Macco Construction Co., Clearwater, $40,829.80.

CONTRA COSTA COUNTY—A reinforced concrete slab overhead crossing over the tracks of the A. T. & S. F. Railway Co. at Pinole, consisting of 11 thirty-four foot spans and two 25-foot 6-inch spans on reinforced concrete bents and abutments and approximately 0.4 mile of approaches to be constructed. District IV, Route 14, Section Pin., Her. Macco Construction Co., Clearwater, $97,133; Heafey-Moore Co., Fredrickson & Watson Construction Co., Oakland, $92,184; Chas. L. Harney, San Francisco, $101,779; Eaton & Smith, San Francisco, $102,431; Bates & Rogers Construction Corp., Oakland, $104,027; B. A. Howkins & Co., San Francisco, $110,141; R. G. Clifford, San Francisco, $110,427; Williams Bros. & Hass, Inc., & P. J. Walker Co., San Francisco, $114,374. Contract awarded to Union Paving Co., San Francisco, $86,263.50.

CONTRA COSTA COUNTY—Across the west branch of San Pablo Creek, about five miles west of Lafayette, a reinforced concrete arch culvert to be repaired. District IV, Route 75, Section A. C. C. Gildersleeve, Berkeley, $4,711; L. C. Seidel, Oakland, $4,357; Palo Alto Road Materials Co., Palo Alto, $5,387; R. G. Clifford, San Francisco, $5,424. Contract awarded to S. H. Von Gelder, San Francisco, $3,753.08.

HUMBOLDT COUNTY—Across Bridge Creek, about 19 miles north of Garberville, a reinforced concrete slab and girder bridge, consisting of five 24-foot spans on concrete pile bents and one 40-foot span on concrete bents with spread footings to be constructed about 0.15 mile to be graded and surfaced with plant-mixed surfacing. District I, Route 1, Section C. Robert McCarthy, San Francisco, $39,658. Contract awarded to E. E. Smith, Eureka, $31,604.

HUMBOLDT COUNTY—Between Benbows and one mile north of Dean Creek, about 0.4 mile to be graded and surfaced with road-mix surfacing. District I, Route 1, Sections A. B. Hemstreet & Bell, Marysville, $85, 502; N. M. Ball Sons, Berkeley, $89,850; Claude C. Wood, Lodi, $92,699; M. J. Ruddy, Modesto, $99,983. Contract awarded to Poulos & McEwen, Sacramento, $84,635.20.

HUMBOLDT COUNTY—Reinforced concrete bridge at Whittemore Grove State Park, District I. Scheumann & Johnson, Eureka, $11,972; Fred J. Maurer & Son, Eureka, $13,036; E. E. Smith, Eureka, $11,850. Contract awarded to Claude C. Wood, Lodi, $10,572.

HUMBOLDT COUNTY—Across Old River, about two miles south of Fernbridge, a reinforced concrete bridge to be repaired. District I, Route 58, Section A. V. R. Scheuman and C. H. Johnson, Eureka, $8,925. Contract awarded to Ernest E. Smith, Eureka, $8,895.

LAKE COUNTY—Between Le Trianon and Scotts Valley road, about 2.1 miles to be graded and surfaced with untreated crushed gravel or stone and seal coat applied. District I, Route 15, Section A. Hemstreet and Bell, Marysville, $78,390; Fredericksen & Westbrook, Lower Lake, $79,204; N. M. Ball Sons, Berkeley, $81,937; Poulos & McEwen, Sacramento, $84,070; Larsen Bros. & Harms Bros., Sacramento, $89,621; J. R. Reeves, Sacramento, $106,493. Contract awarded to J. L. Conner & Sons, Monterey, $69,456.50.

LOS ANGELES COUNTY—Overhead crossing over the tracks of Southern Pacific Co. on Daly Street at Alhambra Avenue. District VII, Route 4, Section L. A. Gibbons & Reed Co., Burbank, $42,230; Dimmitt & Taylor, Los Angeles, $39,846; The Contracting Engineers Co., Los Angeles, $42,765; Carlo Bongiovanni, Los Angeles, $40,317; Baruch Corporation, Los Angeles, $40,220; W. E. Robertson, Los Angeles, $37,481; Fred E. Potts Co., Los Angeles, $37,239; J. S. Metzger & Son, Los Angeles, $38,500; Crow Bros. Construction Co., Los Angeles, $36,415. Contract awarded to J. E. Haddock, Ltd., Pasadena, $35,808.06.

LOS ANGELES COUNTY—Near Saugus, about 2.9 miles bank protection fence to be constructed. District VII, Route 23, Section H. A. Dimmitt & Taylor, Los Angeles, $22,283; Byerts & Dunn, Los Angeles, $24,020; Geo. J. Bock Co., Los Angeles, $24,202; Gibbons and Reed Co., Burbank, $29,378. Contract awarded to Griffith Co., Los Angeles, $18,535.

DISTRICT III, various locations, about 663 miles of traffic stripe to be applied. Awarded to Al W. Simmonds, Sacramento, $3,178.

LOS ANGELES COUNTY—Between 1.5 miles north of Azusa and San Gabriel River bridge, about 0.7 mile to be graded and surfaced with plant mixed surfacing. District VII, Route 62, Section A. R. L. Oakley, Pasadena, $137,813; Claude Fisher Co., Los Angeles, $170,533; Basich Bros., Torrance, $143,260; Oswald Bros., Los Angeles, $80,670; Warren Southwest, Inc., Los Angeles, $226,936; Shannahan Bros., Huntington Park, $156,181; United Concrete Pipe Corp., Los Angeles, $89,750; W. E. Hall & A. S. Vinnell Co., Alhambra, $170,145. Contract awarded to Lewis Construction Co., Los Angeles, $64,237.00.

LOS ANGELES COUNTY—On Ramona Blvd. near L. A. County Sheriffs Pistol Range, about 0.10 mile in length, drainage structures and Portland cement concrete pavement to be constructed on portions. District VII, Route 26, Section D. R. H. Travers, Los Angeles, $32,167; C. O. Sparks & Mundo Engineering Co., Los Angeles, $36,191; J. S. Metzger & Son, Los Angeles, $28,935; Dimmitt & Taylor, Los Angeles, $25,689; Oberg Bros., Los Angeles, $26,619; Geo. J. Bock Co., Los Angeles, $27,891; Claude Fisher Co., Los Angeles, $26,829; J. E. Haddock, Ltd., Pasadena, $29,099; Edward Green, Los Angeles, $33,828; Nick Perscallo, Los Angeles, $32,551; Oswald Bros., Los Angeles, $28,170; Rodich and Brown, Burbank, $32,265; Tomei Construction Co., Van Nuys, $26,970; Contracting Engineers Co., Los Angeles, $27,430; United Concrete Pipe Corp., Los Angeles, $27,641; C. F. Robbins, Los Angeles, $27,077. Contract awarded to G. O. Gartz, Los Angeles, $23,676.90.

MENDOCINO COUNTY—Between 0.3 mile north of Sonoma County line and Squaw Rock, about 0.2 mile to be graded and surfaced with plant-mixed surfacing. District I, Route 1, Section L. N. M. Ball Sons, Berkeley, $37,061; Hemstreet & Bell, Marysville, $40,743; Pacific States Construction Co., San Francisco, $47,645. Contract awarded to Hanrahan Company, Redwood City, $33,899.70.

NEVADA AND PLACER COUNTIES—Between Indian Springs and one mile east of Rainbow Tavern, 7 separate portions of construction totaling about 0.9 mile, consisting of 0.3 mile to be graded and road-mix surface treatment applied thereto, and channel changes and rip-rap to be constructed. District III, Route 37, Section A, F. Fredericksen & Westbrook, Lower Lake, $47,355; Independent Construction Co., Ltd., Oakland, $49,504; Pacific States Construction Co., San Francisco, $51,330. Contract awarded to Lee J. Immel, Berkeley, $47,291.

PLACER COUNTY—Approaches to Colfax grade separation, about 1.2 miles in length to be graded and surfaced with plant-mixed surfacing on crusher run base. District III, Route 37, Section B, Cfx., C. Hemstreet and Bell, Marysville, $50,179; Mountain Construction Co., Sacramento, $50,853; Pacific States Construction Co., San Francisco, $51,302; Independent Construction Co., Ltd., Oakland, $52,065; M. J. Ruddy, Modesto, $59,291. Contract awarded to Piazza and Huntley, San Jose, $46,491.80.

RIVERSIDE COUNTY—Across middle fork of San Timoteo Creek, about one mile northwest of Beaumont. A reinforced concrete slab bridge consisting of three 22-foot spans and two 17-foot 6-inch spans on concrete bents and abutments with steel pile foundations to be constructed and 0.8 mile to be graded and surfaced with plant-mixed surfacing. District VIII, Route 26, Section A. Oswald Bros., Los Angeles, $33,982; United Concrete Pipe Corp., Los Angeles, $38,150. Contract awarded to Byerts & Dunn, Los Angeles, $28,142.50.

RIVERSIDE COUNTY—At Whitewater River Bridge, an earth dike to be constructed and protected with slope paving. District VIII, Route 26, Section D. W. R. Shriver, Los Angeles, $14,567; R. E. Hazard & Sons, San Diego, $17,918; C. G. Willis & Sons & Chas. G. Willis, Los Angeles, $16,052; Dimmitt & Taylor, Los Angeles, $12,375; S. E. Edmonson & Sons, Los Angeles, $20,563; W. E. Robertson, Los Angeles, $14,099; J. S. Metzger & Son, Los Angeles, $17,360; Oswald Bros., Los Angeles, $12,557. Contract awarded to United Concrete Pipe Co., Los Angeles, $12,207.50.

SACRAMENTO COUNTY—An undergrade crossing under the tracks of the Southern Pacific Railroad about 4 miles northeast of Ben Ali Station and about 0.2 mile of roadway to be graded and paved

with Portland cement concrete. District III, Feeder road. Azevedo Construction Co., Sacramento, $82,466; J. R. Reeves, Sacramento, $83,593; Holdener Construction Co., Sacramento, $84,900. Contract awarded to Campbell Construction Co., Sacramento, $77,011.80.

SAN BENITO COUNTY—Between Paicines and Tres Pinos, about 0.8 mile slope protection to be constructed. District V, Route 119, Section E. Lee J. Immel, Berkeley, $18,304; Independent Construction Co., Oakland, $18,600; N. M. Ball Sons, Berkeley, $18,792; E. T. Lesure, Oakland, $19,110; L. C. Seidel, Oakland, $20,160; F. Kaus, Stockton, $22,668; Granite Construction Co., Watsonville, $22,737; Valley Construction Co., San Jose, $26,640. Contract awarded to Piazza and Huntley, San Jose, $17,640.

SAN DIEGO COUNTY—Between Oakley Ave. in La Mesa and Grossmont, about 2.1 miles to be graded and portions to be paved with Portland cement concrete and plant-mixed surfacing. District XI, Route 12, Section L.Msa,B. Claude Fisher Co., Ltd., Los Angeles, $212,944; David H. Ryan, San Diego, $233,251; N. M. Ball & Sons & H. E. Parker, Berkeley, $179,643; V. R. Dennis Construction Co., San Diego, $192,335; Daley Corp., San Diego, $172,450; Crow Bros. Construction Co., Los Angeles, $175,679; Macco Construction and R. E. Hazard & Sons, Clearwater, $180,657; Fredericksen & Westbrook, Lower Lake, $178,722; Basich Bros., Los Angeles, $197,993. Contract awarded to Griffith Co., Los Angeles, $162,930.30.

SAN DIEGO-IMPERIAL COUNTIES—Between Boulder Park and Mountain Springs, about 2.6 miles to be graded and road-mix surface treatment applied. District XI, Route 12, Section H.A. Jahn & Bressi Construction Co., Los Angeles, $330,551; Claude Fisher Co., Ltd., Los Angeles, $284,429; Daley Corp., San Diego, $254,756; Sharp & Fellows Contracting Co., Los Angeles, $269,244; V. R. Dennis Contracting Co., San Diego, $299,942; Oswald Bros., Los Angeles, $249,559; Griffith Co., Los Angeles, $284,293; R. E. Hazard & Sons and R. A. Bell, San Diego, $259,611. Contract awarded to A. S. Vinnell Co., Alhambra, $237,962.

SAN FRANCISCO—Between Lake Street and Golden Gate Bridge approach in the city of San Francisco, about 2.1 miles to be graded including about 1300 feet of reinforced concrete tunnel construction. District IV, Route 56, Section S. F. Fredericksen & Westbrook, Lower Lake, $750,315; Clinton Construction Co., San Francisco, $711,274; Eaton and Smith, San Francisco, $685,755; Bates & Rogers Construction Corp., Oakland, $753,599; R. G. Clifford, San Francisco, $817,763; MacDonald & Kahn Co., Ltd., San Francisco, $643,781; George Pollock Co., Sacramento, $774,466; David H. Ryan, San Diego, $665,061; Barrett & Hilp and Chas. T. Harney, San Francisco, $763,833; Union Paving Co., San Francisco, $657,626; Heafey-Moore Co., Fredericksen & Watson Construction Co., Oakland, $645,810. Contract awarded to Macco Construction Co., Clearwater, $593,042.

SAN JOAQUIN COUNTY—On Moseley road between Terminous road and Peltier road, about 4.4 miles to be graded and surfaced with untreated crushed gravel or stone. District X, feeder road. Claude C. Wood, Lodi, $31,831; Louis Biasotti & Son, Stockton, $34,107; Piazza and Huntley, San Jose, $35,697; J. R. Reeves, Sacramento, $39,168; A. Teichert & Son, Inc., Sacramento, $42,914. Contract awarded to N. M. Ball Sons, Berkeley, $30,416.

SAN LUIS OBISPO AND SANTA BARBARA COUNTIES—About 35 miles east of Santa Maria, timber bridge across Cuyama River to be reconstructed, and west approach to be graded and surfaced with plant-mixed surfacing. District V, Route 57, Section B. Thorsten and Dahl, Los Angeles, $10,845; S. A. Cummings, San Diego, $14,428. Contract awarded to E. G. Perham, Los Angeles, $10,320.

SANTA CRUZ COUNTY—At Two Bar Creek, about one mile north of Boulder Creek, a multiplate corrugated metal pipe culvert to be installed and about 0.2 mile of roadway graded and surfaced, crusher run base and armor coat. District IV, Route 116, Section B. Granite Construction Company, Ltd., Watsonville, $15,691; L. C. Seidel, Oakland, $15,843; R. G. Clifford, San Francisco, $16,853; L. C. Karstedt, Watsonville, $17,969. Contract awarded to Peerless Welding Co., San Francisco, $13,810.

SIERRA COUNTY—At Downieville, across the north fork of north fork of Yuba River, a bridge consisting of one 120-foot steel truss span on concrete piers and two 49-foot concrete girder spans on concrete bents and approaches about 0.5 mile to be graded, surfaced with untreated crushed gravel or stone. District III, Route 25, Sections A, B. Paul J. Tyler, $99,666. Bid rejected—too high.

SISKIYOU COUNTY—Between Callahan and Fort Jones, about 5.6 miles road-mix surfacing to be placed and penetration oil treatment and seal coat to be applied. District II, Feeder road. Hemstreet and Bell, Marysville, $17,887; A. Soda and Son, Oakland, $21,125. Contract awarded to Garcia Construction Co., Irvington, $14,356.25.

In Memoriam

JOHN EDGAR STEWART

John Edgar Stewart, assistant highway engineer in Central Office, Division of Highways, passed away at his home in Sacramento on September 24th after an illness of several months.

Mr. Stewart was born in Virginia, October 7, 1878. He received his engineering education in Iowa State College, graduating in 1902 with a degree in civil engineering. Subsequent to his graduation he was employed for a period of three years as instructor in civil engineering in the Iowa State College.

From 1906 to 1913 Mr. Stewart worked in gauging and computing stream flows for the United States Geological Survey, after which he accepted a position with the Southern Pacific Railroad as an instrument man.

Mr. Stewart entered the employ of the Division of Highways in 1916 and remained in the highway service until his death. For many years he was associated with the staff of District III in charge of office projection and grade design.

Since 1933 he has been employed on the central office staff, much of his work having to do with Federal Aid projects.

The many friends who have been associated with John Stewart during his twenty-two years with the Division of Highways deeply regret his passing.

Los Gatos-Santa Cruz Project

(Continued from page 13)

ing 750,000 station yards additional to that given hereinbefore. Cut slopes have been designed with a view to slide prevention as far as is reasonable within the restraints of economy and good judgment. However, some slides have already occurred, others will. These slides are of the fall rather than the creeping type, and are due to weak, soft shale formation rather than unfavorable position of bedding planes.

The project is being carried on to completion by Colonel John H. Skeggs, District Engineer of District IV. The heavy excavation is being done by Heafey-Moore Co. and Fredrickson-Watson Company, the contractor. A. M. Walsh is Resident Engineer for the Division of Highways.

U. S. Funds To Build Super-Highway

The Federal Government is supplying all of the money to build a 162 mile toll super-highway between Harrisburg and Pittsburgh, Pennsylvania, costing $58,000,000. Of this huge sum, $26,000,000 will be a direct grant from the Public Works Administration and $32,000,000 a loan from the Reconstruction Finance Corporation.

This super-highway, the first of its kind undertaken in the United States, will be a four-lane road following the roadbed of the South Penn Railroad, begun as a rival to the Pennsylvania Railroad between Harrisburg and Pittsburgh many years ago, but never finished.

Construction will be under the direction of the Pennsylvania Turnpike Commission.—*Highway Highlights.*

"And this is your bump of curiosity."

"Right, Professor. I got that by sticking my head in the elevator shaft to see if the elevator was going up. It was coming down."

STATE OF CALIFORNIA

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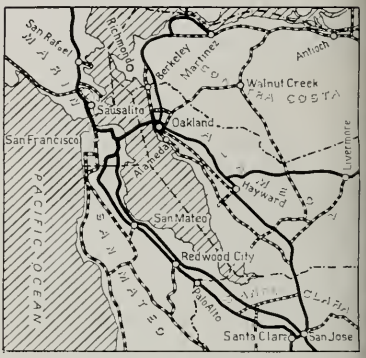
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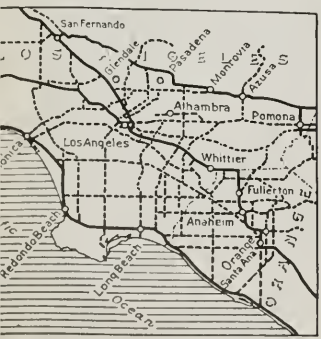
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Primary Roads
Secondary Roads
Proposed Roads



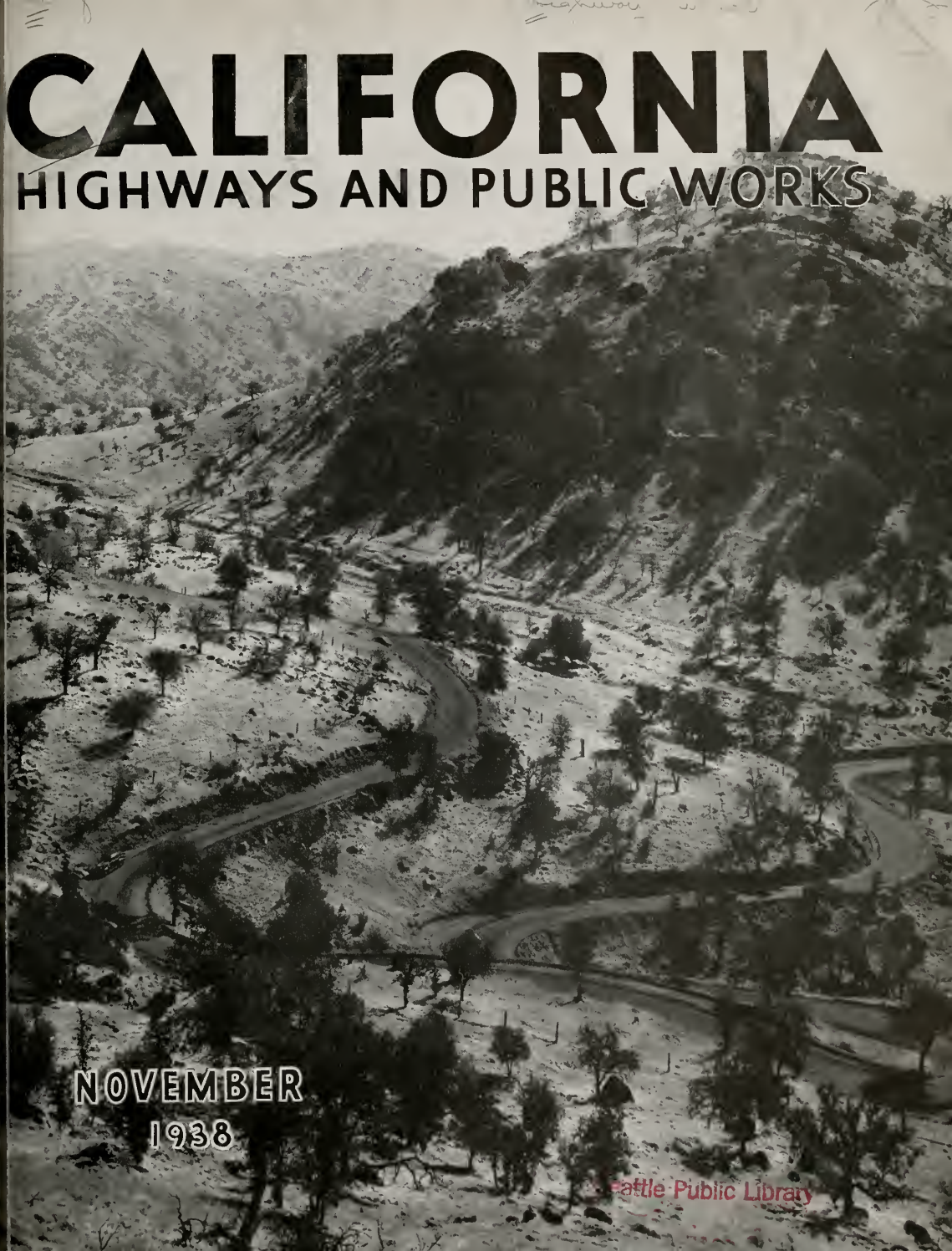
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See Detail Map

See Detail Map

CALIFORNIA
HIGHWAYS AND PUBLIC WORKS



NOVEMBER
1938

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CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways of the Department of Public Works, State of California

EARL LEE KELLY, Director C. H. PURCELL, State Highway Engineer JOHN W. HOWE, Editor K. C. ADAMS, Associate Editor

Published for information of the members of the department and the citizens of California

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Vol. 16 NOVEMBER, 1938 No. 11

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Important Highways in District VI Will Require Large Expenditure to Provide Adequate Service

By EARL T. SCOTT, Acting District Engineer

THE greater part of the productive San Joaquin Valley is included in District VI of the Division of Highways. This district covers one-eighth of the area of California and embraces five counties: Madera, Fresno, Kings, Tulare and most of Kern.

The area composing the district extends for nearly two hundred miles from the Tehachapi Mountains in the south to the Merced County line at the north, and from the Coast Range Mountains on the west to the high Sierra which flank the entire easterly boundary.

Between these mountainous confines on the east, south and west an intricate network of roads and highways serves the broad San Joaquin Valley with its varied agricultural interests and active oil industry. The main trunk of this network is State Route 4 (U. S. 99) which extends from the southerly limits to the north in almost a straight line for 189 miles. This 189 miles is an important part of the transportation route which connects the metropolitan area of Los Angeles with Sacramento and the San Francisco Bay region. Feeding this major traffic artery, and extending out into the cotton and grain fields, the vineyards, the oil fields and mountain recreational areas, the secondary highways bring the district's State highways to a total of 1580 miles.

This total mileage is improved to the following extent:

38 miles, or 2%, unimproved and unoiled earth roads.
604 miles, or 38%, oiled earth roads.
15 miles, or 1%, graveled roads with light oiled surface.
281 miles, or 18%, intermediate type of surface.
642 miles, or 14%, of high type pavement.

While the percentage of high type pavements in this district is high, on much of this mileage the roadway widths are inadequate to properly carry the traffic imposed upon them.

U. S. Route 99 in this district, known locally as the Golden State Highway or Valley Route, carries an average of 6647 vehicles for a 16-hour period, reaching a maximum of 11,256 vehicles at the south city limits of Fresno. Of this average volume over 16% are trucks, and in addition to the trucks over three dozen through motor busses travel the route between 6:00 a.m. and 10:00 p.m.

On this highway may be seen truck and trailer loads of a very large variety of commodities. Huge loads of grapes are trucked to wineries, as about one-half the vineyard acreage of California is to be found in this district. Truck and trailer loads of cotton, oranges, grape fruit, wheat, barley and deciduous fruits of various varieties reaching this artery over the secondary highways add to the congestion.

While more than 22 miles of this route will soon be completed as an adequate four-lane pavement, there still will remain 118 miles of 20-foot pavement and 49 miles of 30-foot pavement which should be widened to four divided lanes before this important highway will safely and adequately carry the increasing volume of traffic. Such improvement is estimated to cost about $13.166,000.

Heavy Traffic Flow Needs Wider Roads



Top—Steep, narrow mountain grade east of Dunlap on State Highway 41, Fresno County. Center—Heavy truck and trailer loads of oil field equipment subject Route 138 to hard surface wear. Bottom—Lumber trucks on narrow grade of Route 76.







Top—Hauling 68,000-pound load on oil-field road near Rosedale in Kern County. Center—One-way bridge across the San Joaquin River, limited to eight tons, on State Highway 125, the Yosemite Highway north of Fresno, leading to the southern entrance to Yosemite National Park. Bottom—Truck and trailer loads of baled cotton on State Highway 135, an oiled earth surface road.

Although the intermediate and lower type of roads make up 59% of the district's mileage, the volume of traffic imposed upon most of these roads justifies their improvement to higher standards. The traffic count of last July shows a considerable increase over the count of July, 1937. At some stations, particularly on the west side of the district on highways leading to the oil fields, the count was double that of last year.

These roads, most of them classified as oiled earth, carry the heavy trucks and trailers transporting oil well supplies and oil well products. The importance and volume of such traffic can be realized when it is considered that 44% of the oil produced in California comes from three of the five counties making up this highway district, namely Kern, Kings and Fresno.

The present oil fields will produce for many years to come and new fields are being developed. The State highways serving these fields are inadequate and as funds become available these narrow, winding and rolling oil earth roads must be improved if the traffic is to be properly served.

In the westerly section of the district many miles of State highways, constructed by counties and later taken into the State system, were built on low grade lines and are subjected to flooding every year. Many of these roads parallel large ditches, with the pavement surface often several feet below the water level in the ditch. Seepage from the ditches keeps the subgrade saturated most of the year and maintenance crews can not keep pace with the surface failures that occur. Only raising of the height of the roadbed with imported borrow material can put these highways above the water and stop the excessive maintenance costs.

On State Route 142 the flow of traffic to Oildale and the oil fields to the north of Bakersfield is heavy, being in excess of 11,000 vehicles for

Top—State Highway No. 41, in Fresno County, near Mendota, is subject to flooding every winter causing excessive maintenance costs. Center—Tank truck and trailer on Bakersfield to Mohave highway, all-year route from California to Arizona, a narrow, winding road with many curves. Bottom—Truck waiting for passenger car to cross one-way bridge near Firebaugh in Fresno County.







the 16-hour period. The two lane pavement and the long, narrow two-way bridge across the Kern River are required to carry this large volume of traffic and the presence of many heavy trucks contributes to the severe traffic congestion which occurs daily. A wider pavement and a new bridge, either on this route or on an alternate route, should be provided.

Extending along the easterly side of the valley the high Sierra provide many recreational areas. Two of California's four National Parks, General Grant and Sequoia, lie entirely within this highway district. The southerly entrance to Yosemite National Park and a part of this popular Park are also in this distract. Thousands of motorists annually visit these National Parks, and the many lake and mountain resorts.

These tourists come from all parts of California and from all sections of the United States. Safe and adequate highways should be provided for this traffic, but unfortunately, many of the highways leading to the recreational areas which were built by the counties are still narrow and crooked. The road surfacing is usually of the lower types and requires constant and expensive maintenance.

Snows block most of the roads in these mountain districts during the winter months and many remain closed for long periods as sufficient funds are not available for snow removal on all routes. Requests and petitions are received each year from various organizations for snow removal on the highways leading into winter sports areas which are not kept open, but such requests must be denied until more money is at the disposal of the Division of Highways for this work.

To keep up with the increasing volume of traffic on the State highways in the district, to provide adequate roads for the "farm to market" and "oilwell to market" trucks,

(Continued on page 24)



Narrow Newhall tunnel through Santa Susana Mountains is being transformed into open cut as indicated by dotted line.

Eliminating a Tunnel Bottleneck

By R. C. MYERS, Assistant District Office Engineer

THE Newhall Tunnel on State Highway 23 (U. S. 6) in Los Angeles County, which for years has presented one of the most annoying highway bottleneck conditions in Southern California, is rapidly being eliminated as a hazard and inconvenience to traffic.

This famous tunnel, which has served nearly three decades of traffic, was built in 1910 to replace the historical Fremont Pass Cut through the Newhall range of mountains. The tunnel, which has a bore of only 17 feet, 5 inches, was a great improvement over the old one-way road through the narrow Fremont Pass at the time of its construction and was entirely adequate for the then existing traffic and for several years thereafter.

However, traffic rapidly increased and soon the tunnel, which only provided two narrow lanes for traffic, was entirely inadequate for the tremendous volume of automobile travel using the road.

The normal traffic between the Los Angeles area and the Owens River and Antelope Valley regions was quite heavy, amounting to about four thousand cars per day, but the bottleneck condition was greatly aggrevated on Sundays during the wild flower season in Antelope Valley and during the winter sports season at the Los Angeles Playground at Big Pines.

MILE LONG BLOCKADE

On certain of these days as many as twenty thousand cars passed through the tunnel in nine hours. For four hours during one of these days there was an average of three thousand cars per hour passing through the tunnel. Traffic was blocked for more than one mile back of the tunnel causing an intolerable traffic condition.

Under the present improvement, the hill above the tunnel is being removed forming an open cut of sufficient width to easily handle present-day traffic on this highway. While the elimination of the tunnel is one of the most important features of the present project, it is only part of a 3.73 mile contract which extends from Tunnel Station, where this highway leaves San Fernando Road, to Placerita Canyon on the so-called Mint Canyon Short Cut.

The old highway from Tunnel Station to a point about four-fifths of a mile north of the Newhall Tunnel is being thoroughly modernized by improving alignment and widening the roadbed. From this point



Newhall tunnel cut as it appeared with mountain slopes excavated permitting traffic to proceed beside and over the old bore.

(four-fifths of a mile north of the tunnel) the road bears to the right on new alignment on what is known as the new Mint Canyon Short Cut toward Solamint on the Mint Canyon Highway.

SAVES 5.42 MILES

This will roughly form one side of an equilateral triangle of which Saugus and Solamint are the other two vertices. By cutting across on this side of the triangle a saving in distance of 5.42 miles will be affected and all traffic on U. S. Highways 395 and 6 from points East via Reno and Owen's Valley to Los Angeles will be saved this distance. The present contract extends as far as Placerita Canyon, leaving a distance of three miles from Placerita Canyon to Solamint to be constructed under future contract.

Work on the entire contract is proceeding satisfactorily although it is found necessary to considerably flatten the cut slope on the easterly edge of the old tunnel to secure proper stability on account of the badly broken up condition of the formation and the slope of the bedding planes on this side. The westerly side of the cut is in very stable formation with the bedding planes so sloped that there is practically no danger of slides.

COMPLETED IN SPRING

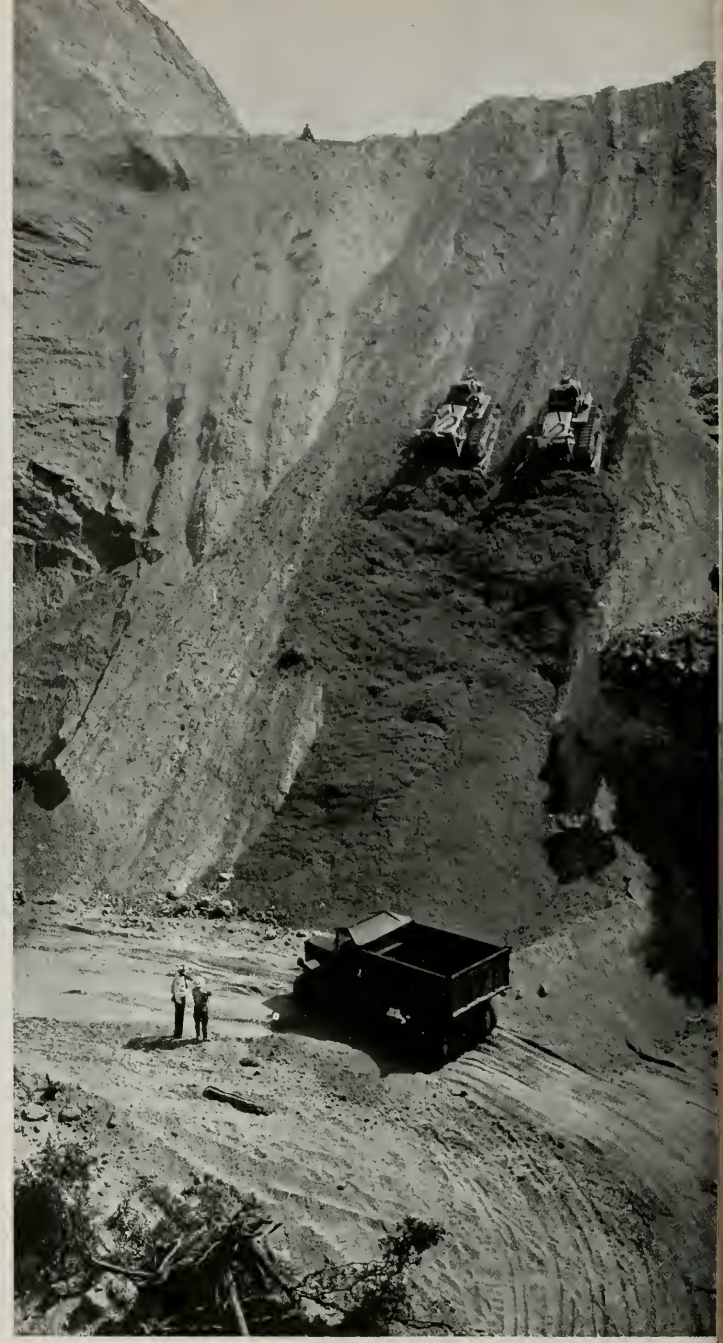
Removal of the concrete tunnel lining, although somewhat delayed by slides on the easterly side of the cut, is expected to be completed by the latter part of this year and the present contract should be completed early next Spring.

The cost of the present contract will be in the neighborhood of $410,000 and will involve upwards of 550,000 cubic yards of excavation, more than half of which will be made at the tunnel cut. The Griffith Company of Los Angeles are the contractors.

For the portion of the road between Tunnel Station and the point where the Mint Canyon Short Cut leaves the present road to Newhall, the highway is designed for exceptionally heavy traffic and will consist of four traffic lanes with a raised curb dividing center strip 4 feet wide and wide plant-mixed shoulders.

The two center traffic lanes nearest the dividing strip will be 12 feet wide each of plant-mixed surfacing. Out-

(Continued on page 28)



Newhall cut involved about 300,000 cubic yards of excavation. Tractors pushing dirt down for removal by shovel and truck.



Construction scene on new highway known as Mint Canyon cut-off east of the old Newhall tunnel site. Lower photo shows widening operations eliminating a sharp curve on present approach road to old tunnel site.





View of Shasta Dam site looking up stream. Solid black line and white dash line show where dam will be built across Sacramento River. Arrow indicates portal of diversion tunnel under contruction.

Dedication of the Shasta Dam

STATE OFFICIALS, some of whom have been for more than fifteen years working toward and looking forward to the day when the Sacramento River could be harnessed, joined with high Federal dignitaries in celebrating at Redding on Saturday, October 22, the start of large scale operations on Shasta Dam, key unit of the great Central Valley Project.

Representing President Roosevelt, Secretary of the Interior Ickes, accompanied by John C. Page, Commissioner of the United States Bureau of Reclamation, came from Washington to play the leading part in the ceremonies attending the formal official launching of the $170,000,000 undertaking which will mean so much to California in water conservation, flood control and the development of hydroelectric power. Sharing honors with Secretary Ickes and Commissioner Page, was Walker R. Young, Supervising Engineer of the Bureau of Reclamation.

The ceremonies were attended by many prominent officials and citizens from all parts of the Central Valley, who have worked unselfishly for years in the interest of the project. Among those present were Congressmen Harry L. Englebright, in whose district the Shasta Dam is located and Albert E. Carter, representative from Alameda and Contra Costa counties. Both of these Congressmen have worked unceasingly to secure congressional authorization and appropriations for the project.

State Senators Bradford S. Crittenden, John B. McColl, James Wagy and Charles Deuel and Assemblyman Clinton J. Fulcher participated in the ceremonies. The Central Valley Project Association was represented by Clarence Breuner, Chairman, Ralph Kern, Floyd Booe and James R. Fauver. The City and County of Sacramento were represented by James Dean, City Manager, and Charles Deterding, County Executive, respectively. The Southern Pacific Company was represented by J. H. Dyer, W. H. Kirkbride, E. E. Mayo and J. E. Given. G. B. Hjelm, U. S. Attorney for the Northern District of California, A. L. Conard of Red Bluff, William Johnson, Pacific Contractors, Inc., and Warren N. Woodson of Corning, active supporters of the project, attended the dedication.

Arriving from San Francisco, Secretary Ickes and his party were greeted at the athletic field of the Redding High School Saturday afternoon by a large audience, including many federal, state, and municipal officials. Speech making was confined to an address by Secretary Ickes, short talks by Commissioner Page and Mr. Young, and a welcome extended by Judge Francis Carr of Redding who was a member of the Water Commission of the late Governor James Rolph, Jr. The program of speaking and musical renditions by the Redding Municipal and Shasta Union High School bands was necessarily limited because Secretary Ickes had to entrain for Portland Oregon, and a visit to Bonneville and Grand Coulee dams. Immediately following

the ceremonies, Secretary Ickes and his party inspected the site of Shasta Dam near Kennett, transformed within a few months time from an almost inaccessible mountain site covered with manzanitas and chaparral into an area teeming with life and bustling with construction activities.

The start of actual work on Shasta Dam, preceded by building operations on the Contra Costa canal in Contra Costa County, marked the realization of a dream that California engineers have had for more than a quarter of a century. Participating in the celebration were Earl Lee Kelly, Director of the State Department of Public Works and Chairman of the Water Project Authority of California, representing Governor Frank F. Merriam, and Edward Hyatt, State Engineer, who has devoted 17 years of untiring effort to achieve the Central Valley Project. With Mr. Hyatt, were members of his staff, including A. D. Edmonston, Deputy State Engineer, several of whom have devoted many years in working out plans for the huge project.

Generous recognition of Mr. Hyatt's efforts was given from the speakers' platform by Mr. Young when he said, in introducing him: "I wish to introduce Mr. Edward Hyatt, State Engineer of California, who has had as much to do as any man living in making this project possible."

Mr. Young said that he regretted that Colonel R. B. Marshall, known in the engineering profession as the father of the Central Valley Project, was not able to be present at the celebration.

Shasta Dam and the Central Valley Project, Secretary Ickes said in his address, is the federal government's emphatic protest against the squandering of precious natural resources. Pointing out that of the three million acres now under irrigation in the Central Valley area more than one million acres face acute water shortage and abandonment, Secretary Ickes said, "Time was when we fostered a policy of exploitation in order to promote expansion westward and to speed development, but settlement of the west and elimination of the frontier borders have removed this excuse, which was lame at best.

"The day of exploitation is past. We must stop squandering our precious natural resources and must begin dilligently to conserve them by careful planning and systematic effort. Unplanned and unregulated exploitation of a limited water supply has brought parts of the rich area of the Sacramento and San Joaquin Valleys face to face with retrogression. Many acres, once lush in crops, have been abandoned and permitted to revert to desert. This condition can not be permitted to endure. The nation has been slow to realize the vital change in the status of our natural resources which has followed the development of the country."

Secretary Ickes said there was no doubt that additional appropriations for the project will be forthcoming.

"The present administration in Washington is solidly committed to the Central Valley Project development," he declared. "Its construction has been fully authorized by Congress and funds made available to date total $36,900,000. There are two particular reasons why the Central Valley Project is considered meritorious by the federal government. One is that it is a multiple purpose project. It will conserve and regu-



Secretary Harold L. Ickes, Department of Interior, posed with Federal and State officials at Shasta Dam dedication ceremonies. Left to right—Earl Lee Kelly, Director of Public Works; John C. Page, U. S. Reclamation Commissioner; Secretary Ickes; State Engineer Edward Hyatt; Walker R. Young, Supervising Engineer, Bureau of Reclamation.

late the waters of the Sacramento and San Joaquin rivers for the restoration of navigation; the control of floods; the improvement of irrigation; the control of saline encroachment and the generation of electric power. It would be difficult to conceive of a catalog of more diversified and useful purposes.

PRIDE IN DEDICATION

"The other outstanding feature is the fact that it is to be self-liquidating. This is a statutory requirement for every federal reclamation enterprise. I find that the project is feasible from engineering, agricultural and financial standpoints, that it is adaptable for settlement and farm homes; that the estimated construction cost is adequate, and that the anticipated revenues from the sale of water and power will be sufficient to return the cost to the United States.

"It is with great pride that I proclaim the start of heavy construction on Shasta Dam, and dedicate the Central Valley Project to the cause of conservation. The work already proceeding night and day at Shasta Dam site is the beginning of an accelerating program that will command world wide attention.

"Every shovelful of earth and every beat of a jackhammer will bring us closer to the day when the gates and valves of Shasta Dam will be operated to control the flow of the Sacramento River, and when the turbines will be set in motion to turn the electric generators. That day promises the dawn of a new and more glorious Central Valley empire whose manifest destiny of wealth and social well-being will not be denied."

Mr. Young acted as chairman of the day, introducing the speakers and distinguished guests. Describing the scope of the Central Valley Project, he said, "It is not generally known that the Sacramento is a mightier stream than the Colorado. Today the river is at a relatively low stage, but the Sacramento's mean annual runoff is 21 million acre feet compared with the Colorado's 16 million acre feet. The combined annual discharge of the Sacramento and the San Joaquin Rivers into the ocean has averaged 30 million acre feet, water enough to cover every irrigated area in the Central Valley to a depth of ten feet.

"The valley's water supply is ample in quantity; it needs only proper seasonal and geographic distribution. Behind Shasta's wall of concrete will be stored 4,500,000 acre feet of water. This storage capacity will permit the operation of the reservoir for multiple purposes of conservation. It will stabilize the flow of the Sacramento River to diminish the damaging flood peaks in the spring; to eliminate extreme low flow in the fall; to permit a restoration of steamboat and barge navigation as far up the river as Red Bluff; to afford improved irrigation in much of the Sacramento Valley; and to check seasonal encroachment of salt water into the channels of the Sacramento-San Joaquin delta."

AN ARDENT CHAMPION

Commissioner Page, who has been and is an ardent champion of the Central Valley Project, spoke briefly preceding Secretary Ickes. It was Commissioner Page who, on January 25, 1937, following extensive independent investigations by the Bureau of Reclamation, finally selected and approved the Shasta Dam site, then known as the Kennett Dam site, as the main storage unit on the Sacramento River. His action upheld State Engineer Hyatt's recommendation to the legislature in 1931 after extensive investigations that the Kennett site be selected. Prior to recommending the present location of Shasta dam, the State Engineer and his assistants investigated all possible reservoir sites in the Sacramento River basin, including those on main tributaries as well as on the main stream. Shasta Dam site was chosen by the State as a result of the preliminary studies and investigations on the basis of a clear showing of its greater economy and superiority as compared to any other possible storage site.

The Water Project Authority of California under the directions of Public Works Director Kelly is actively assisting and cooperating with the Bureau of Reclamation as the official administrative agency of the State, created by the Central Valley Project Act of 1933 and charged with the responsibility of constructing the Central Valley Project. The technical work of the authority is handled by the engineering staff of the Division of Water Resources under the State Engineer. The work of the State has included the designation and approval of the general engineering plans for the project, and the negotiations for the acquisition of water rights and rights of way. Other important activities are concerned with the disposal and sale of water and electric power to be made available by the project.

Shasta Dam will be one of the largest in the world, ranking with the recently completed Boulder Dam on the Colorado River and the Grand Coulee Dam now under construction on the Columbia River in the State of Washington. It will rise to a height of 500 feet above present low stream level and 560 feet above the lowest foundation. Its length along the crest will be 3,500 feet. It will be a "gravity type" massive masonry structure, slightly curved in plan, requiring more than 5,600,000 cubic yards of concrete.

IN PRELIMINARY STAGES

Most of the work now being done at Shasta Dam is of a preliminary nature, including construction of roads, offices, power lines, camp buildings, and similar facilities. Pacific Constructors, Inc., contractors on the job, are rushing work on the excavation for the dam foundations and erection of necessary shops and other structures, and the camp on the east slope of the Sacramento River Canyon that will handle dam workers.

Secretary Ickes and his party found the main dormitory to house 172 men nearly completed. Clearing work is under way for construction of additional dormitories, and a dining hall which will accommodate 312 men. An electric kitchen will operate 24 hours a day to feed crews when construction is fully under way. Night and day shifts are engaged on the 1820-foot diversion tunnel which will serve as a temporary right of way for the Southern Pacific Railroad and later as a river diversion conduit during dam construction.

DIVERSION TUNNEL UNDER WAY

When Secretary Ickes visited the site the bore had progressed about 300 feet into the south head, while other crews were engaged in excavating the portal of the north head. Excavation has begun for the dam with power shovels operating at various elevations. These shovels will soon be augmented by three 6-yard electric shovels. Each of these shovels is capable of excavating over six tons of material at a scoop. It is estimated that more than three



State Water Department officials at Shasta Dam site: Left to right—George T. Gunston; Everett N. Bryan; R. L. Jones; H. M. Stafford; A. D. Edmonston; Edward Hyatt; T. B. Waddell. Black dashes on hillside indicate foundation lines of upper and lower faces of dam.

million cubic yards of earth and rock will be removed from the slopes of the canyon to provide a suitable foundation for Shasta Dam. Some of the material excavated has been used to grade construction roads, some has been dumped into gullies to provide level spaces for the contractor's camp, and the rest has been deposited into stock piles of various grades for future use in embankment construction.

Above the dormitory site work is proceeding on the contractor's administration building, with offices, drafting rooms and other facilities. Also under construction is a hospital which will contain a twenty-bed ward, four private rooms, and surgical and first aid rooms. Residences will be located nearby. Plans call for construction of eleven 5-room houses, fifty 3-room houses, and seventy-two 2-room structures. The contractor's work shops and railroad yard, which will include a combined warehouse and garage, machine shop, carpenter shop, compressor plant, drill forge and foundry sheds, will be located on a flat near the river. Three miles east of the dam site is located the Bureau of Reclamation camp, including five official buildings, 46 family residences, 27 duplex cottages and two dormitories. Also under construction are the government warehouse and power facilities. A substation to provide electricity for construction uses is being erected on the west bank north of Coram. Power lines are rapidly being built throughout the area.

About 700 men are employed by Pacific Constructors, Inc., awarded the general contract to furnish labor and equipment for construction of Shasta Dam under supervision of Bureau of Reclamation engineers. Ralph Lowry is the Government's construction engineer and Frank T. Crowe is the contractor's general superintendent on Shasta Dam.

About 200 men are employed by the Colonial Construction Company which has a contract to drive an 1820-foot tunnel through the west abutment of the dam site. Sam Bergstrom is the tunnel superintendent.

Approximately 1071 men are employed at the Shasta Dam site with an additional 25 or 30 men engaged in construction of a warehouse.

New Tahoe-Ukiah Highway Link With By-Pass Bridge Completed

THE dedication on Sunday, October 16, of the new bridge and highway near Sutter, which is about ten miles west of Marysville, attracted a crowd of approximately 3,000 persons. The opening of this section of road marked the completion of another step in the program of improvement planned for the Tahoe-Ukiah Highway, State Route 15, which is rapidly developing into one of the most important cross laterals in the State Highway System.

Beginning at high noon, an impressive dedication service was conducted by the Grand Officers of the Native Sons of the Golden West. With Grand President Joseph J. McShane of San Francisco presiding, a bronze plaque was set in the east end of the new bridge over the Sutter By-Pass. The mortar used in setting the plaque was made with sand gathered from all the counties of the State, cement from all the California cement plants, and water from all the historic missions in the State.

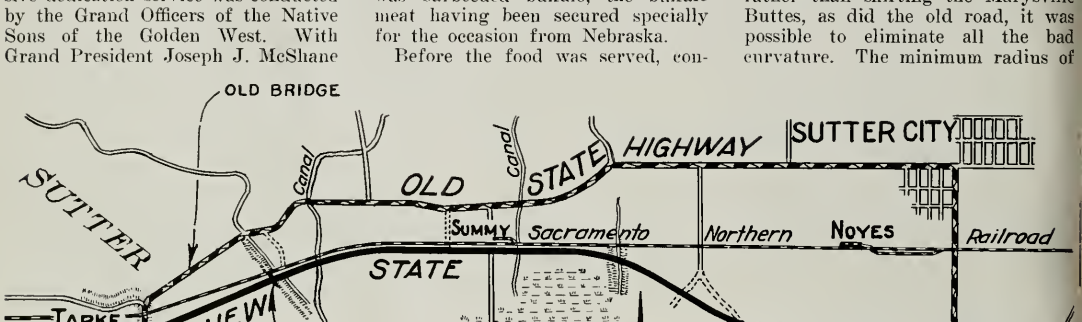
After this ceremony Governor Frank F. Merriam gave a short talk, emphasizing that projects such as the one being dedicated were made possible by the gasoline tax. He discussed briefly the growing importance of the Tahoe-Ukiah Highway as an east-west lateral and expressed the hope that the new link would prove to be a real convenience to public traffic and would always be used safely. Then, with the wish that traffic might always flow freely over the new project, he severed the ribbon and opened the road to public traffic.

The official caravan, followed by many private cars, then drove across the new bridge. After inspecting the project the large crowd gathered under the new bridge, where a fine barbecue had been prepared under the auspices of the West Sutter Men's Club, of which Frank Ettl is president. The main dish of the feast was barbecued buffalo, the buffalo meat having been secured specially for the occasion from Nebraska.

Before the food was served, congratulatory remarks were made by several of the more prominent guests, among whom were Director of Public Works Earl Lee Kelly, State Senator George Biggar, State Senator W. P. Rich, Walter Scott Franklin, and Joseph J. McShane. Governor Merriam was again presented and talked for a few minutes on the great increase in traffic demands during the past 25 years.

The project dedicated supplants a county-built road which was taken over by the State in 1926. While the road was satisfactory for the traffic demands at the time it was built, it possessed several features which made it entirely inadequate for the higher speeds and heavier traffic of the present. There were many bad curves, among them four at right angles. The bridge across the Sutter By-Pass was very narrow and its westerly approach was particularly dangerous, involving a short, steep grade, two right angle turns and a grade crossing of the Sacramento Northern Railway.

The new project, which is 5.5 miles long, extends from Tarke to one mile south of Sutter. Constructed entirely on new alignment, it is about 1¼ miles shorter than the old road. Since it traverses flat, open country rather than skirting the Marysville Buttes, as did the old road, it was possible to eliminate all the bad curvature. The minimum radius of curvature on the new construction is 5,000 feet, the maximum central angle being 34 degrees. In designing the new alignment, it was also found possible to eliminate the two grade crossings of the Sacramento Northern Railway.



The surfacing on the project consists of plant-mixed bituminous treated crushed rock 22 feet wide by 0.21 of a foot thick, on a crusher run base 23 feet wide by 0.4 of a foot thick. The total width of the graded roadbed is 36 feet.

Included within the limits of the project is a new reinforced concrete slab bridge, 4,149 feet in length and providing a clear roadway width of 24 feet between curbs. This modern



At top, section of new Tahoe-Ukiah lateral realignment. Center—New reinforced concrete bridge across Sutter By-Pass. Upper inset shows flood water conditions. Lower inset shows jumbo moving falsework unit of deck span. At bottom, left to right, State Senator W. P. Rich; Miss Stuart Franklin; Public Works Director Earl Lee Kelly; District Engineer C. H. Whitmore; N. L. Nagler; Governor Merriam; Frank Ettl; Parker Reische; Judge Coates; Maitland Pennington; Dr. W. S. Franklin.



New concrete bridge across Sutter By-Pass on Tahoe-Ukiah Lateral is 4149 feet long and 24 feet wide between curbs.

new structure replaces the old narrow one which was very inadequate for present-day traffic.

The grading and surfacing contract was completed at a cost of approximately $140,000, the work being done by Hemstreet and Bell. Mr. W. G. Remington was resident engineer for the State.

The cost of the bridge, which was built concurrently under a separate contract, was about $230,000. The contractors were Heafey-Moore Co., Fredrickson and Watson Construction Co., and Fredrickson Brothers. The resident engineer for the State was Mr. W. H. Johnson.

CONTAINS 190 SPANS

The structure contains one hundred sixty-seven identical 22-foot spans and twenty-three identical 15-foot spans. It is of a continuous concrete slab construction supported by concrete pile bents containing three piles per bent. This large number of identical spans and the comparatively smooth condition of the stream bed made it possible for the contractor to devise a unique and interesting construction method.

The first twenty-eight 22-foot spans and the first four 15-foot spans were constructed by the usual method. The falsework for the remainder of the spans was designed as a unit so that each unit could easily be set up and taken down. Each unit was entirely supported by the columns. This was accomplished by the use of 6-inch by 8-inch by 3-foot 3-inch timber blocks milled to fit the circular columns which were bolted on each side of the columns with three 1½-inch bolts. These blocks supported the 6- by 18-inch caps which, in turn, supported the 6- by 18-inch stringers.

Hardwood wedges were used between the blocks and the caps for the purpose of bringing the bottom of the deck form to grade and to facilitate in stripping, wedges were used between caps and stringers. Five-eighth inch plywood was used for decking.

Thirty-two units were constructed and each unit was used six times. This number of units was necessary so that the contractor could maintain a definite deck pouring schedule. Each pour included four and one-half spans and an average of three pours was made per week.

UNITS MOVED ON JUMBO

After the concrete had set sufficiently, each deck unit was released and moved ahead to a new location and re-erected. It was constructed so that it could be raised or lowered by means of railroad jacks under each corner and was pulled along and set in place with a 60 h.p. tractor. This operation consists of towing the jumbo under the span to be stripped. The weights under the deck stringers were removed which lowered the falsework about 2 inches. The stringers were then raised from the falsework caps, the falsework caps removed and the deck section entirely supported by the jumbo was then ready to move to the next location.

The next step in the process was to move the jumbo with the deck unit ahead where the deck unit could be used for pouring another section. The deck section of the jumbo was then raised just enough to clear the cap and pulled into place, finally lowered on the cap and the jumbo was free to be used in placing another section. The average number of units moved and erected per week was fifteen.

"You admit you drove over this man with a loaded truck?"

"Yes, your honor."

"And what have you to say in your defense?"

"I didn't know it was loaded."

Mabel—What's worrying you, David?

Farmer's Son—I was just wondering if Dad would see to the milkin' while we're on our honeymoon, supposin' you said "Yes" if I asked you to marry me.—*Omaha Bee.*

George B. McDougall Retires After 25 Years as State Architect

APPOINTED August 22, 1913, George B. McDougall, State Architect, who retired from public service on October 31, under civil service regulations, had charge of State building construction work having a total valuation of approximately $65,000,000 during his term of office.

Some of the outstanding building projects more recently constructed under his supervision were the State Office Building No. 1 and the Library and Courts Building on Tenth Street in Sacramento, the State Building in San Francisco, the State Building in Los Angeles, the Motor Vehicle and Public Works Buildings on N Street in Sacramento, and the beautiful Camarillo State Hospital in Ventura County.

Governor Frank F. Merriam has said that the Camarillo Hospital from a standpoint of its architectural beauty and modern facilities is Mr. McDougall's outstanding achievement. His office also prepared the plans and specifications and is supervising the building of the new State office building at 10th and N streets, Sacramento, now under construction.

Since 1933, Mr. McDougall has had charge of approving for structural safety the plans and specifications for all new public school buildings in California. The total estimated value of these structures is approximately one hundred million dollars.

BUSY FOUR YEARS

The last four years under Governor Merriam's building program have been the busiest of the 25 years Mr. McDougall served as State Architect. Since June of 1934, Governor Merriam has authorized or made available a total of $37,322,819 for construction and improvement of State buildings and other construction activities, all of which have come under the supervision of the State Architect.

Of this total amount, $19,164,165 has been expended or allocated for State benevolent institutions including hospitals for the insane, Veterans' home, homes for the feeble minded, home for aged women, and home for adult blind. The balance of $18,158,754 has been expended or allocated for State schools and colleges, prisons, fairs, expositions, State office housing, and miscellaneous necessary improvements.



GEORGE B. McDOUGALL

Mr. McDougall was born in San Francisco on October 11, 1868. His father, Barnett McDougall, was an architect in the Bay City. As a boy Mr. McDougall earned his first dollar reading water meters in San Francisco on Saturday afternoons for which he was paid 25 cents per meter per month. His first continuous employment was in the office of Superior Court Reporters in San Francisco and later as stenographer and secretary for the late Joseph D. Redding, San Francisco attorney. Later he was private secretary to Wm. Randolph Hearst when the latter became owner of the San Francisco Examiner.

After five years as an architectural student and draftsman in the office of his father, Mr. McDougall became a member of the firm of McDougall Brothers in San Francisco in 1893. He became State Architect on August 22, 1913, under appointment by the late Wilbur F. McClure, who then was State Engineer under Governor Hiram Johnson. He has served under the administrations of seven different State engineers and directors of public works and under six different governors.

Mr. McDougall is a member of the American Institute of Architects and was president of the San Francisco chapter of the Institute, now called the Northern California Chapter, for two terms. He was also regional director for the Institute for the Western Region comprising California, Nevada, Arizona and Hawaii.

During the past forty years, he has been a member of the Sessions and of the Boards of Trustees of the Calvary Presbyterian Church in San Francisco and of the Westminster Presbyterian Church in Sacramento. For many years, Mr. McDougall has been a member of the Managing Board of the California State Association of Young Men's Christian Association and served as president of the Sacramento Y. M. C. A. He has always been interested in music and during his residence in Sacramento has been a member of the McNeill Club. He is a member of the Masonic bodies and the Rotary Club of Sacramento.

Mr. and Mrs. McDougall plan to return to San Rafael, Marin County, and take up residence in their former home located there.

Mr. McDougall has no immediate plans for the future, he says, except to be a frequent visitor to the Golden Gate International Exposition this spring and to journey to the northwest later in the automobile that the employees of the Division of Architecture presented him on his retirement.

"Are you the celebrated lion tamer?"
"No, I only comb the lions and clean their teeth."

Three State Engineers Win Awards in Welding Design Competition

THREE engineers of the California Department of Public Works were among those receiving awards in the recent $200,000 contest sponsored by the James F. Lincoln Arc Welding Foundation.

The object and purpose of the contest, as announced by the sponsors, was "to encourage and stimulate scientific interest in, and scientific study, research and education in respect of, the development of the arc welding industry through advances in the knowledge of design and practical application of the arc welding process, and to provide for the payment of awards, by prizes, to those persons who by reason of the excellence of their papers upon said subject may be selected as most worthy to receive such awards."

The scope of the contest covered all fields of transportation, construction, and manufacturing. Eleven main classifications were set up and were further broken down into 44 subclassifications. That the contest was truly international is shown by the fact that 14 different nations were represented on the award list. The papers received were judged by a jury composed of 31 engineering authorities from universities and colleges.

SUBMITTED BRIDGE DESIGN

In the subclassification on "bridges" a second prize, cash award $508.77, was awarded to a paper jointly submitted by **B. M. Shimkin, Associate Bridge Engineer, Division of Highways, and G. A. Sedgwick, Structural Engineering Associate, Division of Architecture.**

An honorable mention, cash award $101.75, was given the paper presented by Glenn L. Enke, Associate Bridge Engineer, Division of Highways.

The prize winning paper prepared by Messrs. Shimkin and Sedgwick presented the design of "A Two Span Continuous Girder Railroad Bridge." The bridge described is now being built, as a riveted structure, as part of a grade separation project in the San Joaquin Valley. For the purpose of this contest Messrs. Shimkin and Sedgwick redesigned the bridge as a welded structure and then made an economic comparison of the two types.

By making full use of the inherent economies of welded construction the writers said: "a saving of 22½% in weight of metal was obtained. With the development of suitable fabricating shops this saving in metal can readily be translated into a saving in money.

LARGE SAVINGS POSSIBLE

"Considered on a nation wide scale the adoption of welding in the manufacture of plate girder bridges would result in a very large saving every year. As most bridges are now built by public, or semipublic organizations, this saving would be a direct benefit to the traveling public in that more bridges could be built with the available funds. Anyone familiar with the number of dangerous and obsolete bridges now on our highway system will realize the importance of such a saving.

"A careful study of the subject reveals many points in which the welded girder is superior to the riveted girder. In this type of construction welding may be used with confidence. European engineers have been eminently successful in building welded girder bridges of long spans. In this country trained men and adequate fabricating equipment need to be developed to handle this class of work on a production basis.

"That only competent welders should be used on bridge work is generally recognized. Equally important is the necessity of employing engineers trained in the design and construction of welded work.

"From the standpoint of introducing welding into the field of bridge construction the welded girder is of particular importance. The girder is probably the most widely used of any bridge type and is the one most likely to show an appreciable saving in cost when welded.

"Because of its simplicity, the welded girder is readily mastered by workmen and engineers and can be fabricated with equipment available in nearly all large structural steel shops.

"The lessons learned on girder bridges can be readily applied to rigid frames and other more complicated bridge types. The general knowledge and use of welding in bridge construction will open unlimited opportunities for the design engineer to develop new types, greater economies, and better appearing bridges."

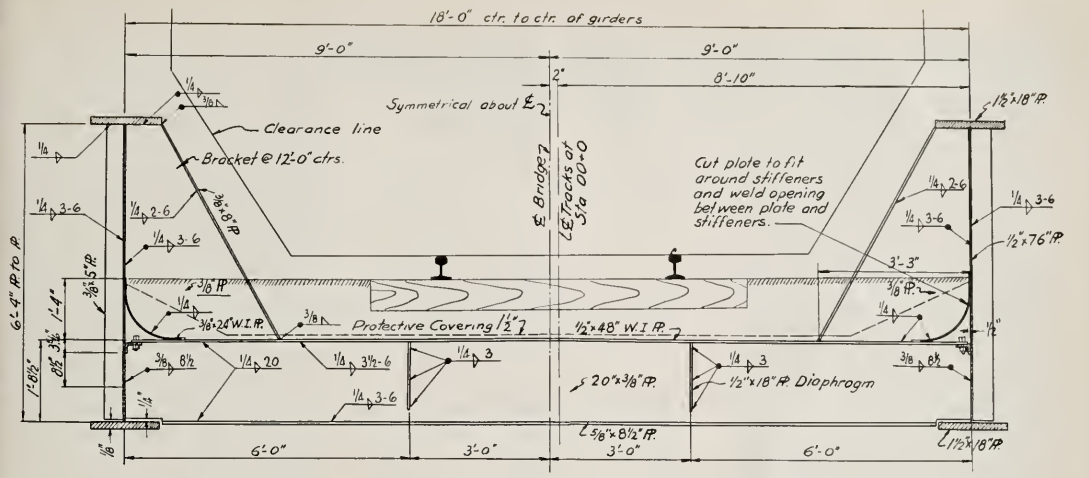
ENKE DESIGN DESCRIBED

The paper submitted by Glenn L. Enke described the "Design of an All Welded 183 foot Through Truss Span, Two Lane Highway Bridge." For purposes of direct cost comparison, this design employed a truss type, span length, and capacity identical with a riveted truss span previously used by the California Division of Highways in two of its bridges. A two-span structure of this type was erected in 1933 across South Fork of Eel River in Humboldt County. Later, in 1935, another span was used in Plumas County for a structure across North Fork of Feather River at Rock Creek. In his paper Mr. Enke said:

"Various types of structures may be used in bridge work. These are, in order of their use from the shortest spans to the longest type of structure: concrete slabs, rolled steel beams, steel plate girders, steel trusses of various types, and steel suspension bridges with stiffening trusses.

"Plate girders reach an upper economical span limit of 100 to 200 feet, dependent upon many factors involving the number of spans, character of the ground surface immediately under the span, transportation facilities to the bridge site, and underclearance requirements for the structure.

"The truss type is necessary in spans longer than the limits stated for a plate girder, and is employed in many variations, such as a single span or "simple" truss, continuous truss,



TYPICAL CROSS SECTION

Design for welded construction of two-span continuous girder railroad bridge for which B. M. Shimkin and G. A. Sedgwick were jointly awarded $508.77.

cantilever truss, and as a stiffening truss when used with a cable system, to form the modern suspension bridge.

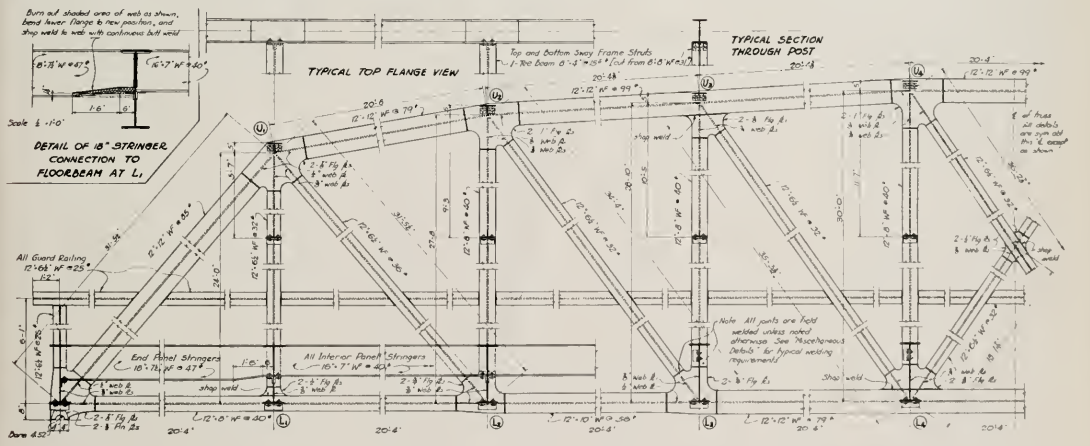
"The 183 foot spau selected for redesign as a welded truss is of a span length and type frequently needed for single span crossings of rivers in the more rugged portions of California. The development of a better and more economical type of design will permit more of these structures to be built with the funds available, and will further the replacement program of obsolete structures that confronts the State at this time.

"The 183 foot welded truss span, as designed, is a 2-lane "through" type of structure in which the roadway is placed between the top and bottom truss members; as contrasted with the "deck" type in which the roadway is placed on top of the truss. The welded design showed a remarkable saving in weight and cost from that of the riveted truss as built in the two locations described above.

"The structural steel in one span of each type, including cast steel bearing supports, weighed 144 tons. The new design in welding weighed but 93 tons. This difference in weight expressed in cost of work and materials will show a large percentage of savings in favor of the welded design. These savings may appear rather startling, but are readily demonstrated by the following general considerations:

"1. The average riveted truss has a large amount of excess detail material in the way of gusset plates, tie plates, lacing bars, all of which are necessary

(Continued on page 28)



Design of all-welded 183-foot, through truss span, two-lane highway bridge that won award of $101.75 for Glenn L. Enke.

Relationship of the Roadway to Highway Traffic Safety

By MILTON HARRIS, Associate Highway Engineer

THE ENGINEERING approach to the traffic accident problem takes the same form as the investigation and solution of any other matter that falls within the realm of the engineers. In dealing with traffic, as with other physical elements, the primary consideration is the collection of sufficient factual data to form a sound basis for logical reasoning and the eventual application of engineering principles to effect a solution of the problem presented.

The rational collection of data appertaining to traffic accidents must necessarily be obtained from reports of all accidents, which in turn are broken down to show those factors that form underlying patterns or are indicative of the causes that in themselves, or collectively, caused these accidents.

Factual data concerning traffic may be collected by survey to ascertain those patterns or habits in which motorists indulge. Survey of the physical or other features that have a hand in shaping these patterns are also in order and come under the head of factual data necessary to be in the hands of the engineer before a logical solution can be generated.

The entire problem of providing a solution is one that challenges the utmost in engineering minds; yet before moving into the virgin field of traffic operation, there still remain problems in highway engineering that demand attention, thought, and solution. Of commanding importance is the role that the roadway plays in traffic safety.

From research conducted by the Safety Department it has been found that the general pattern of traffic accidents in California for the past several years has remained practically constant. The relationship of accident types as well as the reported causes seems to bear the same percentage to the total, year by year. From this fact it is reasonable to hope that the application of a solution to roadway causes will materially alleviate that part of the situation and be reflected in forthcoming statistics.

Of the 12,867 contributing causes reported in 1937, 855 or 6.65% represent those concerning the roadway. A more common evaluation would be to say that the roadway was responsible for 61 deaths and 724 personal injuries during last year.

To clearly portray the relationship of roadway causes to the various elements of highway engineering, the accompanying chart has been prepared, in which the relative percentages of reported causes concerning the roadway alone are shown pyramided on a typical cross-section.

The roadway surface is immediately apparent as requiring the greatest attention to effect traffic safety. Slippery surface alone accounts for more than one half of the problem.

Bay Bridge Reports and Revenues Over Preceding Month

AN increase in October traffic over the previous month on the San Francisco-Oakland Bay Bridge was announced yesterday (Monday) by Director of Public Works Earl Lee Kelly from a monthly traffic report filed by State Highway Engineer C. H. Purcell.

Comparative figures follow:

	Total October	*Total September*	*Total since opening*
Auto Trailers	1,149	1,473	28,921
Passenger Autos	688,232	657,611	16,259,399
Motorcycles	2,677	2,806	61,073
Tricars	983	1,002	19,276
Buses	13,594	13,153	220,779
Trucks	39,384	37,684	640,296
Truck Trailers	1,653	1,637	36,229
Toll Vehicles	747,672	715,367	17,265,973
Auto Passes	13,720	23,245	245,065
Truck Passes	1,591	2,010	23,906
Total Vehicles	762,983	740,622	17,534,944
Extra Passengers	235,728	233,561	4,263,197
Freight Pounds	108,683,917	107,886,750	1,591,338,326

The total number of vehicles to cross the Bay Bridge during October was 762,983, Mr. Kelly said, compared to 740,622 for September. The number of trucks increased from 37,684 during September to 39,384 for October. An average of 24,612 toll vehicles per day paid a total of $399,820.40 during last month, an increase of approximately fifteen thousand dollars over September.

Total number of vehicles to have crossed the bridge this year to date is 7,090,394, and the total since the bridge was opened—17,534,944.

With practically all work completed on the bridge electric railway terminal in San Francisco, work on the interior finish of the structure is being pushed to completion. This work includes the placing of a finish coat at the track level, wainscot painting, and enameling. Completion of the terrazzo floor on the mezzanine of the center unit was under way, with the tile setting for the walls of the east and west units continued. Benches are being placed in the waiting rooms of the street floor, with a general cleanup throughout the building under way.

Third rail has been installed for the tracks at track level.

Obstructions on or along the roadway account for over 16 per cent of the total causes attributable to roadway, with construction or repairs responsible for more than half. Shoulder conditions contributed almost 7 per cent of the hazard, while width contributed approximately 5 per cent.

Here is a challenging portrayal of figures on which highway engineers may whet their technical abilities. Its solution may be their diploma to a larger and better field of endeavor; that of *operating* our system of highways; the traffic executive, if you please.

Solution of traffic problems by the application of scientific principles is not as easy as it sounds. It calls for the use by engineers of all the scientific resources available, the science of psychology and education, the application of the principles of law and medicine and the fundamentals of politics. Above all it calls for executive ability, for no matter how logical the solution or how obvious the answer may be to a traffic problem, it still needs a directing head to put it into action and effect a change.

The highway engineer enjoys a peculiar position in relation to motor traffic. As a civil engineer he was called upon to provide a travelable way on which might run the creations of his brother mechanical engineers. He became an economist in that he might raise money equitably and expend it judicially to appease the terrific pressure that more and more motorists brought to bear in their insatiable appetite for more cars and more roads whereon to travel. Submerged temporarily for the last quarter century under this deluge of roadbuilding, he has at last taken a breath and looked around at his creation, to find that another element has taken form of which he has been only rather dimly conscious.

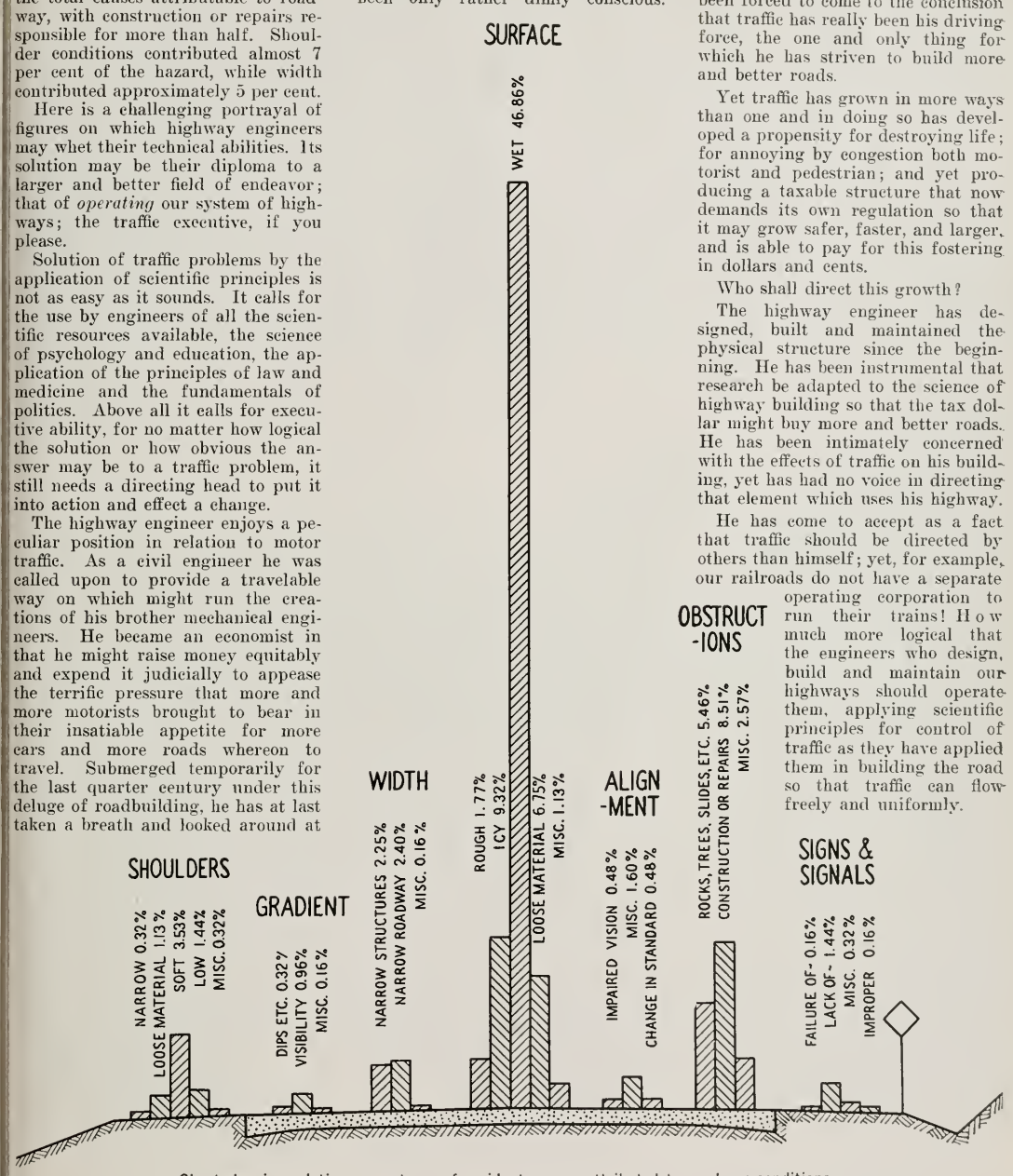


Chart showing relative percentages of accident causes attributed to roadway conditions.

That element is traffic; and upon reflection the highway engineer has been forced to come to the conclusion that traffic has really been his driving force, the one and only thing for which he has striven to build more and better roads.

Yet traffic has grown in more ways than one and in doing so has developed a propensity for destroying life; for annoying by congestion both motorist and pedestrian; and yet producing a taxable structure that now demands its own regulation so that it may grow safer, faster, and larger, and is able to pay for this fostering in dollars and cents.

Who shall direct this growth?

The highway engineer has designed, built and maintained the physical structure since the beginning. He has been instrumental that research be adapted to the science of highway building so that the tax dollar might buy more and better roads. He has been intimately concerned with the effects of traffic on his building, yet has had no voice in directing that element which uses his highway.

He has come to accept as a fact that traffic should be directed by others than himself; yet, for example, our railroads do not have a separate operating corporation to run their trains! How much more logical that the engineers who design, build and maintain our highways should operate them, applying scientific principles for control of traffic as they have applied them in building the road so that traffic can flow freely and uniformly.

Construction Starts on New Mountain Springs Grade Relocation

By EDWARD J. NERON, Deputy Director of Public Works

ON A rocky mountain slope of the Coast Range barrier between Imperial and San Diego counties, Governor Frank F. Merriam on October 29 set off the first dynamite blast starting construction on the proposed new Mountain Springs Grade of U. S. 80.

The Governor was introduced by the Chairman of the San Diego County Board of Supervisors, Mr. T. LeRoy Richards, and delivered the main dedicatory address to a happy audience of Imperial and San Diego County residents who have antieipated this much desired ehange for many years.

This highway has gradually developed from an old wagon stage road rising from the desert below sea level to the summit of the Coast Range. Director of Public Works, Earl Lee Kelly, recently awarded to A. S. Vinnell Company a contraet for reconstructing the upper three miles of the grade.

U. S. Highway 80 is one of the main transcontinental arterials extending through the southern part of the United States from ocean to ocean. In addition to being a route that is open to travel throughout the entire year, the westerly portion is of extreme importance in the development of Imperial and San Diego counties, because it is the connecting link between the great agricultural section of the Imperial Valley, the County and City of San Diego, and San Diego Harbor.

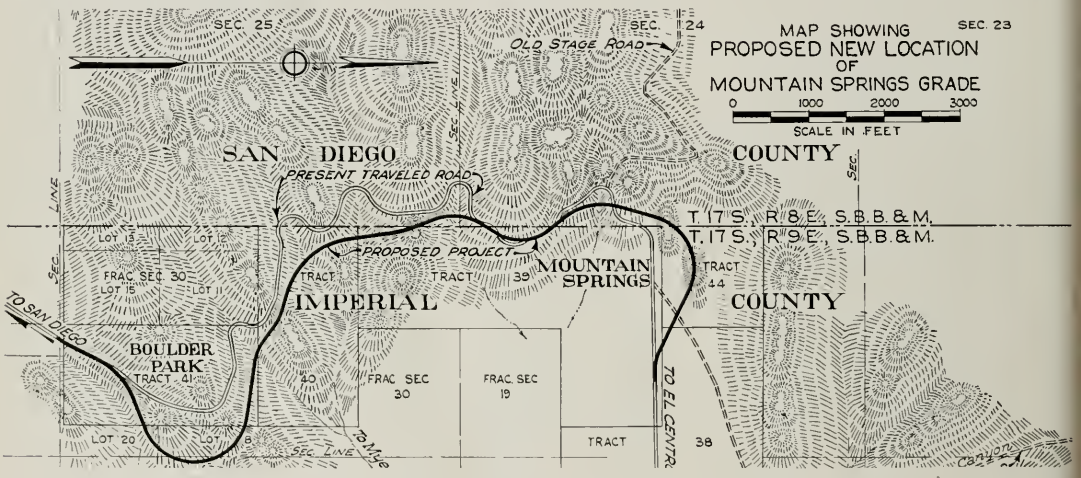
On October 18, 1938, the first Colorado River water was turned into the practieally completed All-American Canal, which will double the irrigable agricultural area in Imperial Valley and provide irrigation for over a million acres of fertile lands.

The Mountain Springs Grade which traverses the county line rises from 44 feet below sea level at El Centro to an elevation of 3240 feet at the summit near the county line. The most westerly portion traverses some of the roughest terrain in this range of mountains and rises quite abruptly from a point known as Mountain Springs to the most westerly point on the county line, known as Boulder Park.

Because of the long grade and very crooked alignment, the passing of trucks and vehicles on this grade is hazardous, and in places impossible. The new grade eliminates 952 degrees of curvature and reduces by 16 the number of curves which exist on the present highway. The minimum radius curvature on the old alignment was 126 feet. The minimum on the new alignment is 600 feet, and all but one are considerably in excess of that. The maximum grade on the old alignment was 7.12% and on the new is 6%.

The new construction involves some very heavy rock work, averaging approximately 100,000 cubic yards of excavation per mile, most of which is on very steep side hill involving engineering problems in distribution and compaction. A considerable amount of cribbing and similar wall work is necessary in order to retain the fills on the steep slopes. It is necessary for the contractor to develop water at Jacumba and trans-

(Continued on page 24)









A novel ground-breaking ceremony was witnessed on the Mountain Springs grade relocation of U. S. 80 in Imperial County when Governor Merriam started the work by setting off a dynamite blast. In the official group, left to right, are: T. L. Richards, George Burnham, E. E. Cavanagh, Clarence Walker, H. R. Judah, Col. Ed. Fletcher, Governor Merriam, Frank G. Forward, L. G. Bradley and Edward I. Neron. The bottom picture shows a section of this narrow winding highway across the mountains between Imperial and San Diego Counties.

New Salinas River Bridge At Soledad Officially Opened

By VERN J. ELE, Resident Engineer

DEDICATION of the new Salinas River Bridge marked the replacement of the old dangerously narrow and weak structure, on Sunday, October 23, 1938.

The bridge is located on U. S. Highway No. 101, a primary route of the State's system, at a point approximately one mile south of the town of Soledad in Monterey County.

This artery is one of the principal routes from San Francisco to Los Angeles, accommodating a large volume of local and tourist travel, as well as a steady through traffic of large commercial vehicles.

The Salinas River channel at the bridge site is about 1,300 feet wide and 30 feet deep. At certain times of the year its appearance is misleading as to the character of the river and the necessity of bridging the entire crossing. During the summer and fall months, there is very little water evident above the ground, and the flow is confined to a small stream which follows a meandering course over the wide river bottom.

During the winter months, after heavy rainfall the river may reach from bank to bank, and attain a depth of eight or ten feet. In periods of high water a large amount of debris consisting of brush and trees is washed down the river, and the flow is accompanied by such a scouring action of the quicksand river bottom that the river bed itself appears to be in motion. Bank erosion has been so severe during the last ten years that it now has reached a critical stage, and is causing an expensive problem to both the State and Federal governments.

Before 1914, the channel was spanned by four 120-foot timber truss spans, with a short timber trestle approach. During the Winter, that bridge, located 1000 feet upstream from the site of the present new structure, was washed out completely by the highest water recorded for the Salinas River.

To improve the alignment a new bridge was located 500 feet downstream. The structure built by Monterey County consisted of eleven 119-foot steel through Pratt truss spans supported on concrete piers. Each pier was formed by two three-foot, steel encased, concrete-filled cylinders. Each cylinder was founded on five 50-foot piles.

Designed for the horse and buggy type of traffic, a macadam surfaced roadway, 16-feet-eight-inches wide, without sidewalks was provided, along with a vertical clearance of 13-feet-seven-inches, one inch more than the present day legal load height.

As the type of traffic changed to motorized high speed vehicles with greater loadings, this structure proved inadequate. During recent years it was posted for one-way traffic for trucks and buses, 15 miles per hour speed limit, and a maximum load of 12 tons per vehicle.

In 1934, the most northerly truss was wrecked by a truck. The truss was never repaired, the roadway being supported on temporary timber bents. In 1935 a portion of the deck was destroyed by fire. The burned-over portion was replaced by new stringers and deck, and the bridge again carried traffic until February 11, 1938. On that date another high water stage, Elev. 174, washed out the south pier of the bridge, carrying the two southernmost trusses with it into the river. Then followed a month of repair work on the damaged structure, under difficult conditions, and with constant threat of further floods. Traffic was detoured from Soledad to King City on a county road along foothills east of the river. The bridge was reopened for travel on March 18, 1938, and served without further interruption to traffic until October 23, 1938, when this continuous reinforced concrete girder type bridge was dedicated to public service.

The new structure is located on a greatly improved alignment, along downstream side of old bridge, and is connected to the existing highway by approximately one mile of concrete pavement approach.

It consists of thirteen (13) one-hundred and four (104) foot spans and two 89-foot end spans on concrete piers, hinged to spread footings founded on Douglas fir piling. The overall length of the new bridge is 1,530 feet having a roadway width between curbs of 34 feet, and two 2′–6″ sidewalks.

The girders are bulb shaped design continuous over two piers and forming two 17-foot cantilevers. Bridge seats on the latter support an 80-foot suspended span, one end of which is hinged to cast steel rockers to allow for expansion.

The design is unique in being the longest span for this type bridge on the State system. The continuous, bulb-shaped girder was favored over the conventional rectangular simple span type, to effect not only a large reduction in cross-sectional area, but a noteworthy saving to the State.

The total cost of the bridge and the approaches amounted to approximately $400,000.

H. R. Judah, California Highway Commissioner, representing Governor Merriam, was the principal speaker at the dedication ceremonies.

The cutting of a ribbon by Chairman Judah signalled the opening of the new bridge and the start of a parade which ended at a nearby municipal park where a barbecued dinner was served.

Others introduced by Al Clark, Master of Ceremonies, were: Mayor John Burke of Soledad: Mayor Leach of Salinas; Congressman McGrath; State Senator Tickle; Supervisors Redding and Talbot of Monterey County; District Engineer Lester Gibson; Bridge Contractor H. S. Lord; Resident Engineers Fred Weigle and Vern J. Ele; Secreatry McCardle of the Salinas Chamber of Commerce; County Engineer Howard Cousins.



The recently completed bridge across the Salinas River on U. S. 101, near Soledad, is the longest continuous bulb-shaped girder type in the State. It is built on improved alignment near the narrow old structure as shown in the center picture. The overall length is 1530 feet with a roadway width of 34 feet between 2½ foot sidewalks.

Blast Starts Work on Mt. Springs Grade

(Continued from page 20)

port it by pipe line 5½ miles to the job where over 13,000,000 gallons will be used for compacting fills.

More than 1000 San Diego and Imperial valley civic leaders, state, county and city officials, navy and marine corps officers and inland San Diego residents gathered at the base of a huge rock tower to watch Governor Merriam formally start the work.

"If you have traveled over this treacherous grade before," the Governor said, "you can appreciate the value this project will be to these two splendid counties represented here today.

"Funds for this work, like all other state highway improvements, come from the highway funds which your gasoline taxes create. It is your money which is being spent for highways which you can long enjoy."

The chief executive reviewed the progress which California has made in building adequate highways for its growing motor and truck travel.

A host of dignitaries, including many who have spent years in supporting highway development for San Diego and Imperial county, were presented by the master of ceremonies.

Frank G. Forward, chamber of commerce highway committee chairman, headed a committee on arrangements. Working with him were Fred Simpson, county highway development association president; Neil Brown, chamber shippers' committee chairman; Pat D. Smith, Fred Rhodes and James Robbins.

Representing the most Rev. Charles Francis Buddy, bishop of San Diego, was the Rt. Rev. Monsignor John M. Hegarty, vicar general of the Catholic diocese of San Diego, who was accompanied by Albert V. Mayrhofer.

C. L. Cotant, chamber president, headed a large delegation of chamber of commerce members, and Claude Wilson, Escondido, represented the San Diego County Development federation. Councilman Herbert E. Fish represented the city; Vice Adm. E. J. King, the navy; Brig. Gen. J. J. Meade, the marine corps.

State officials and legislators included Assemblywoman Jeanette Daley, Assemblyman Charles Stream, Nat Rogan, Collector of internal revenues; R. L. Dean, acting regional forester; Harry A. Hopkins, assistant director, department of public works; Edward J. Neron, deputy director public works; E. E. Wallace, district engineer; E. E. Sorenson, assistant to Wallace; R. R. Judah, chairman, state highway commission; William T. Hart, local representative of the highway commission.

In Memoriam

IRA A. THOMAS

On October first, at a sanitarium in San Diego, Ira A. Thomas, Maintenance Superintendent for the Division of Highways at El Centro, passed away.

Mr. Thomas had been ill only a short while prior to going to the hospital, three days before his death, and to all his many friends in District XI, knowing his abounding vitality and high spirits, his passing was a great shock.

Everyone in Imperial County, and the employees of the Division of Highways throughout the State, affectionately knew him as "Tommy." His friends were legion, as he took an active, enthusiastic and helpful part in sports, public affairs, and particularly in the activities of the California State Employees Association and he was president of the Imperial County chapter for several terms.

During his earlier manhood, Mr. Thomas took a prominent part in the building construction industry in San Francisco, and as a general contractor erected many large buildings in that city. Following the San Francisco earthquake in 1906, he conceived the idea of utilizing brick from the ruined buildings as coarse aggregate for concrete in building foundations and street work, and thereby was instrumental in expediting the early reconstruction of the city.

About twenty-three years ago Mr. Thomas went into the building industry in Imperial Valley where he erected many of the larger buildings, county bridges and other construction installations. He entered the service of the State in 1931 as superintendent in charge of all maintenance and betterment work on the State highways in Imperial County. His thorough knowledge of conditions and broad acquaintance throughout the valley, added to his wide experience in construction work, have been of exceptional value to the State. Added to these qualifications, his great enthusiasm for the work, his willingness to meet any situation that might arise at any time of the day or night, and his joy in the best accomplishment, contributed to his unusual success in meeting many emergencies and difficult situations which are encountered almost continuously in the valley and the surrounding desert.

He took a keen interest in roadside trees and plantings and installed a fine collection of cacti and desert growth at the El Centro Maintenance Station that has attracted the attention of many tourists and nature lovers. He also directed the installation of the notable beautification of the Imperial County Fair Grounds of that type.

Highways in Dist. VI Require Large Expenditure

(Continued from page 3)

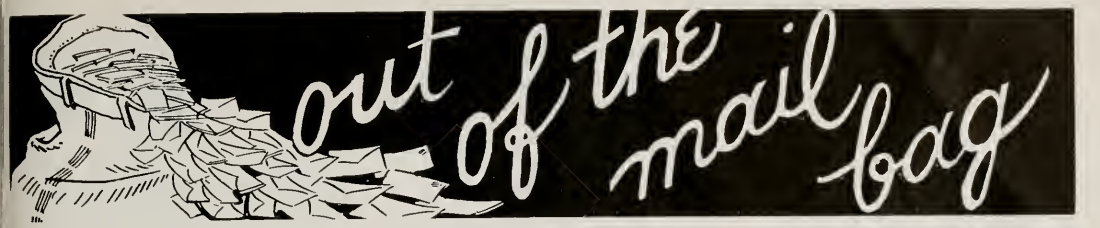
and to build safety into the highway system will require the following improvements:

38 miles	Unimproved earth roads in need of reconstruction and oiling	$1,337,500
599 miles	2-Lane oiled earth or gravel roads in need of reconstruction	20,657,700
567 miles	2-Lane intermediate and high type in need of reconstruction	14,610,800
118 miles	2-Lane, widen to 4-lane divided, with structures	9,210,000
49 miles	3-lane, widen to 4-lane divided with structures	3,956,000
	10 Highway and Railroad grade separations and bridges not shown above	2,000,000
	Acquisition of Right of Way	5,475,000
		$57,247,000

Since funds are not now available to carry this program through to an early completion, the period required to do the desired work must be extended to fit the yearly budgetary amounts.

The highways to be constructed, re-constructed or otherwise improved must be those which, after an exhaustive study, from the standpoint of maintenance cost, traffic, safety, etc., most urgently need consideration.

Here's to happy days: any old fool can have a good time at night.



Has Four-year File

P. O. Box 756
Santa Maria, Cal.
October 6, 1938

Division of Highways
Sacramento, Cal.

Gentlemen:

I have been receiving your publication CALIFORNIA HIGHWAYS AND PUBLIC WORKS magazine for same four years and would like to commend you for your work in publishing this magazine. I find it a very valuable as well as interesting way of keeping posted as to the progress being made on State highways and their maintenance, together with other valuable information.

I have been saving these magazines and binding them together by the year, and have found many an occasion to refer back to them. Somehow my August, 1938, issue got mislaid, so I would therefore appreciate it very much if you would forward me a copy of that issue so I can keep my yearly volumes complete, and up to date.

Very truly yours.

Paul E. Smith.

Old Roads and New

Alpine, Calif., October 25, 1938.

California Highway & Public Works,
Sacramento, Calif.

Dear Sirs:

I have just had the privilege and pleasure of seeing and reading the August and September numbers of your beautiful magazine and I must say that I am quite anxious to be included in the list of those to whom it is regularly sent if that may be.

As one who came to Los Angeles in the Summer of 1881 when that city had but 11,000 inhabitants and when a road was generally an open space between the place you happened to be and the place you desired to reach, and when it was usually made by driving a wagon from the one place to the other until another person could see and follow your tracks and any work done upon it was largely done by men who wished to work out their "pole tax," and having ridden or driven by horse from Santa Monica to San Jacinto, San Diego to Santa Barbara, Oakland to Santa Cruz, San Luis Obispo, over desert and mountains to Bakersfield, up the San Joaquin to Lodi and back to Oakland (Oakland to Oakland being one saddle trip of 800 miles in seven weeks), I can discern some difference in the old and the present roads. I left California in 1893 and drove back from Chicago in a small car in 1917. We were six weeks getting to San Bernardino and we had our ninth new tire on the car when we arrived. Since then I have driven over about 150,000 miles in this state, from the Mexican line to Calistoga and from San Bernardino to Sacramento, and if anybody should be able to appreciate the development of our roads, I think I should, and I certainly do. With sincere appreciation of both the roads and the magazine.

Very truly yours.

J. B. STUYVESANT,
Cozy Cove Cottages.

King County Planning Commission

County-City Building, Seattle
September 30, 1938.

State Highway Department,
Sacramento, California.

Gentlemen:

We understand that you are publishing a most interesting monthly magazine.

We will appreciate it very much if you will put us on your mailing list—if there are extra copies which can be spared.

Thanking you, we are

Yours very truly,

JOSHUA H. VOGEL,
Planning Engineer and Executive Officer,
King County Planning Commission.

Enjoyed by Nicaragua's President

Consualdo General De Nicaragua

San Francisco, California,
October 22, 1938.

Editor, California Highways
and Public Works,
Sacramento, California.

Sir:

Allow me the pleasure to present to you and to your able staff my very sincere congratulations for the helpful information you always give in the worthiest State's publication: "CALIFORNIA HIGHWAYS AND PUBLIC WORKS."

Really it is a pleasure to receive it every month. After I read each edition I mail it to Honorable Dr. Antonio Flores-Vega, Ministro de Fomento y Obras Publicas in the Cabinet of His Excellency, General Anastasio Somoza, President of the Republic of Nicaragua, who also enjoys it.

I remain, yours truly,
JUAN JOSE MARTINEZ LACAYO,
Consul General of Nicaragua.

Praises California Highways

Monrovia, California.

California Highways
and Public Works,
Sacramento, Calif.

Gentlemen:

We sure can appreciate the California highways, and the way they are kept in fine condition. After we took a two-month trip through the middle western and southern states, we can readily appreciate our highways. Even though some are black topped and gravel, the California highways are better than the average in other states.

I am enjoying the "California Highways and Public Works" journal very much because it is very educational, and compliment your staff for maintaining a high standard of constructive journalism and fine printing.

Yours very truly,

DEWEESE W. STEVENS.

Aids Yale Research

Yale University
Bureau for Street Traffic Research

New Haven, Conn.,
October 20, 1938

Editor California Highways
and Public Works,
P. O. Box 1499,
Sacramento, California.

Dear Mr. Howe:

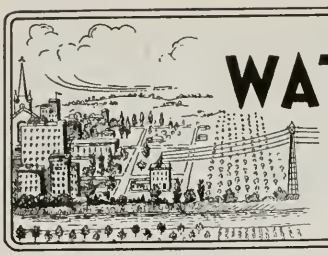
The photographs of the Bakersfield-Grapevine highway, which you so kindly forwarded to us recently, have been added to our visual aids library. I am very happy to have them and wish to thank you very much indeed.

I wonder if I might further impose upon your kindness by requesting copies of the photographs illustrating John H. Skeggs' article dealing with modernizing roads, which appears in the September issue of CALIFORNIA HIGHWAYS AND PUBLIC WORKS. On pages 1, 2, and 3 there is a series of eight exceptionally fine photographs showing bad road construction and practices. If it is convenient, I would very much appreciate receiving copies of these. * * * We now hava a collection of some 800 photos taken in New England. Should you desire some special classifications please feel free to call on us.

Thanking you again, I am

Sincerely yours,

BRYANT BURKHARD,
Research Assistant.



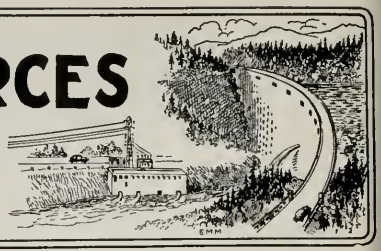
DIVISION OF WATER RESOURCES

OFFICIAL REPORT

FOR THE MONTH OF

October, 1938

EDWARD HYATT, State Engineer



SEVERAL applications for allotments from money appropriated to the Emergency Fund by Chapter 11, Statutes of 1938, Extra Session, for the restoration of public property, levees, flood control works, county roads and bridges, damaged by floods of the 1937-38 winter season throughout the State, were received during the past month.

Investigations of applications received so far have been or are being made and 188 reports and recommendations have been prepared by the Division of Water Resources and State Reclamation Board and submitted to the Director of Finance, pursuant to his instructions. Governor Frank F. Merriam has approved allocations totaling $4,194,400 for flood damage repair work covered by these reports. The Division of Water Resources has continued the performance of some of the work for which these allocations were made, the remaining work being done by the applicants under contracts entered into with the Department of Public Works. There are now in force 114 contracts for work which will cost $3,097,000.

IRRIGATION DISTRICTS

The Delano-Earlimart Irrigation District was formed at an election held October 18, 1938, following a favorable report by the State Engineer to the Board of Supervisors of Tulare County as to the feasibility of the project. The district embraces an area of 33,000 acres of highly developed agricultural land that has a deficient water supply owing to the receding ground water level. Organization was undertaken in order to contract for a water supply from the Friant-Kern Canal of the Central Valley Project which will pass through the district area.

Investigation of a project submitted by the El Dorado Irrigation District is now in progress. The proposal includes the construction of a dam on Sly Park Creek to store 12,700 acre feet of water, and the building of an eight-mile conduit through the hills to connect the reservoir with the present distribution system. The estimated cost of the project is $670,000.

Work has been started on the Nevada Irrigation District project, recently approved, for the building of Scott's Flat Dam. The district reports a crew of thirty men supplied by WPA will undertake clearing of the reservoir site during the winter months pending receipt of a loan and grant from PWA to carry out construction.

SUPERVISION OF DAMS

Palos Verdes Reservoir, one of the principal terminal reservoirs of the Metropolitan Water District of Southern California system, will soon be constructed in the Palos Verdes hills. Application for the approval of the plans and specifications for its construction were filed on October 11, 1938.

Repair work is progressing satisfactorily on a number of dams throughout the State. In addition to these a number of recent applications have been filed for the repair of structures before winter.

WATER RIGHTS

Supervision of Appropriation of Water

During September, 25 applications to appropriate were received, 19 were denied and 15 were approved by issuance of permits. In the same period 5 permits were revoked and the rights under 5 permits were confirmed by the issuance of licenses.

The field season in connection with the inspection of projects under permits and investigation of protested cases was concluded on September 28th. A total of 228 projects were inspected, distributed throughout practically all counties of the State. Reports of these investigations are now being prepared.

FLOOD CONTROL AND RECLAMATION

Maintenance of Sacramento Flood Control Project

Routine maintenance on the flood control project has been carried on during this period in preparation for high water this winter, consisting mostly of minor repairs to structures. Temporary repairs have been made to several of the by-pass bridges.

The War Department is installing additional culverts in the west intercepting canal, so that there will be no recurrence of overflow similar to that which occurred last winter. Two additional 60-inch culverts are being installed.

The application for a PWA grant for maintenance repair work has not yet been granted, and there appears to be little prospect that it will. We are therefore preparing to do the necessary work with the funds at hand.

Relief Labor Work

An average of 125 relief laborers have been employed in clearing in the Feather River overflow channel, repairing current retards at Nicolaus and constructing wing dams at Robinson Bend. Fifty laborers are employed from the SRA transient camp in Sutter Basin.

The WPA application covering flood control work in District No. 2, containing the valley counties from the delta north to Trinity County, has been approved. This will permit the clearing of numerous flood and creek channels outside of the Sacramento project. It is expected that some of this work can be performed in cooperation with the War Department, particularly in Yolo-Colusa and Butte counties.

Clearing of levee right-of-way at the Sacramento brickyard below Sacramento has been practically completed by a crew of 15 WPA laborers.

Emergency Levee Repairs

The work of completing flood damage repair in Glenn, Butte, Shasta and Tehama counties under Executive Order E 177, has been almost completed. Work is now under way on Butte Creek and Feather River at Robinson Bend, in Butte County, and on Stony Creek, in Glenn County. The work will be completed as soon as these units are finished.

SACRAMENTO-SAN JOAQUIN WATER SUPERVISION

During the past month the efforts of the field men from this office have been devoted almost entirely to making a field survey of the crops and areas irrigated from the stream and return flow channels in the Sacramento and San Joaquin Valleys. The acreage data gathered will be incorporated in an annual mimeographed report containing all data relative to diversion from and water discharged to the streams in the Sacramento-San Joaquin Valley area.

Prof.—Take this sentence: "Let the cow be taken out of the lot." What mood?

Frosh—The cow.

Highway Bids and Awards for the Month of October, 1938

GLENN COUNTY — About 3½ miles north of Willows, reinforced concrete box culvert to be constructed and existing pavement to be replaced with untreated crushed gravel or stone base and plant-mix surfacing. District III, Route 7, Section B. A. A. Tieslau, Berkeley, $5,959. Contract awarded to N. M. Ball Sons, Berkeley, $5,795.50.

HUMBOLDT COUNTY—Across east branch of south fork of Eel River, 2.7 miles south of Garberville, a reinforced concrete slab supported on concrete and timber bents consisting of eight 10-foot spans replacing portions of existing bridge and approach thereto. District I, Route 1, Section A. Fred J. Maurer and Son, Eureka, $22,474. E. E. Smith, Eureka, $25,181; T. T. Lesure, Oakland, $28,605; Fred J. Early, Jr., San Francisco, $29,319. Contract awarded to Scheumann and Johnson, Eureka, $21,-141.00.

HUMBOLDT COUNTY—Between Big Lagoon and one mile north of Orick, about 1.4 miles to be graded and surfaced with road-mix surfacing. District I, Route 1, Sections J,K. John Burman & Sons and Scheumann & Johnson, Eureka, $77,918; N. M. Ball Sons, Berkeley, $84,108; Hemstreet & Bell, Marysville, $87,339; Poulos & McEwen, Sacramento, $93,013. Contract awarded to Claude C. Wood, Lodi, $77,-642.00.

IMPERIAL COUNTY—City of El Centro, East Main Street, S.P.R.R. to east city limits, and 5th and 6th Streets, State to Orange Streets, 1.3 miles plant-mix surfacing. District XI, Route 27. V. R. Dennis Construction Co., San Diego, $22,-901; R. E. Hazard & Sons, $9,523. Contract awarded to G. W. Ellis, North Hollywood, $9,185.00.

INYO COUNTY—Between Death Valley National Monument and Death Valley Junction, about 11.1 miles to be graded and road-mix surface treatment applied. District IX, Route 127, Section L. Oilfields Trucking Co., Bakersfield, $80,608; Fredericksen and Westbrook, Sacramento, $63,451; C. G. Willis & Sons, Inc., and Chas. G. Willis, Los Angeles, $77,062; J. A. Casson, Hayward, $48,886; Basich Bros., Torrance, $55,-787; Griffith Co., Los Angeles, $72,928; S. Edmondson & Sons, Los Angeles, $67,-037; Crow Bros. Construction Co., Los Angeles, $54,326; George Herz & Co., San Bernardino, $79,556; Isbell Construction Co., Reno, $74,004; Dodge Construction, Inc., Fallon, $69,116; Parish Bros., Eldridge, $59,671; United Concrete Pipe Corp., Los Angeles, $78,049. Contract awarded to Oswald Bros., Los Angeles, $48,856.40.

KERN COUNTY—Between Weedpatch and Wheeler Ridge, about 16.8 miles to be graded and treated with liquid asphalt. District VI, Feeder road. Oilfields Trucking Co., Bakersfield, $36,372; Griffith Co., Los Angeles, $36,412; Basich Bros., Torrance, $37,378; Heuser and Garnett, Glendale, $40,208; Claude Fisher Co., Ltd., Los Angeles, $42,010. Contract awarded to Rexroth and Rexroth, Bakersfield, $34,-813.00.

LASSEN COUNTY—Between Madeline and Likely, about 4.4 miles to be graded and surfaced with crusher run base and road-mix surfacing. District II, Route 73, Section F,G. Harms Bros., Vinton, $77,-372; Piazza and Huntley, San Jose, $82,-123; Fredericksen & Westbrook, Sacramento, $87,508; Isbell Construction Co., Reno, $95,222; Mountain Construction Co., Sacramento, $97,433; N. M. Ball Sons, Berkeley, $107,985. Contract awarded to Poulos & McEwen, Sacramento, $74,969.80.

LOS ANGELES COUNTY—A reinforced concrete girder overhead crossing over the tracks of the Southern Pacific Co. about 6 miles east of Saugus, consisting of one 66-foot span, one 56-foot span, one 54-foot span, and one 49-foot span. District VII, Route 23, Section I. Griffith Co., Los Angeles, $46,303; White & Wilberg, Santa Monica, $46,442; United Concrete Pipe Corp., Los Angeles, $47,914; Byerts & Dunn, Los Angeles, $49,021; C. O. Sparks and Mundo Engineering Co., Los Angeles, $50,191; Oscar Oberg, Los Angeles, $50,-896; The Contracting Engineers Co., Los Angeles, $51,996; Gibbons and Reed Co., Burbank, $53,115; Ralph A. Bell and Donald E. Metzger, Los Angeles, $56,978; Nick Perscallo, Los Angeles, $67,083. Contract awarded to W. E. Robertson, Los Angeles, $37,902.00.

LOS ANGELES COUNTY — Between Rivera Underpass and Shenandoah Avenue, about 1.7 miles to be graded and surfaced with Portland cement concrete, asphalt concrete, and plant-mixed surfacing. District VII, Route 168, Section B. Griffith Co., Los Angeles, $33,163; United Concrete Pipe Corp., Los Angeles, $33,704; Oswald Bros., Los Angeles, $36,222; C. O. Sparks & Mundo Engineering Co., Los Angeles, $36,706; Sully-Miller Contracting Co., Long Beach, $37,975. Contract awarded to W. E. Hall Co., Alhambra, $32,880.00.

LOS ANGELES COUNTY—Between French Flat and Liebre Gulch, about 2.7 miles to be graded, heavy riprap to be placed and Portland cement concrete slope paving to be constructed. District VII, Route 4, Section I. Claude Fisher Co., Ltd., Los Angeles, $145,710; Ralph A. Bell, Monrovia, $164,485; United Concrete Pipe Corp., Los Angeles, $174,440; Griffith Co., Los Angeles, $195,381; Nick Perscallo, Los Angeles, $199,937. Contract awarded to Geo. J. Bock Co., Los Angeles, $122,205.00.

LOS ANGELES COUNTY—Across Castaic Creek near Castaic Junction, a bridge to be constructed; and about 0.7 mile to be graded and surfaced with plant-mixed surfacing and road-mix surface treatment applied to shoulders and detours. District VII, Route 79, Section A. J. S. Metzger & Sons, & L. A. Paving Co., Los Angeles, $78,799; Dimmit & Taylor, Los Angeles, $73,274; Heuser & Garnett, Glendale, $73,-546; R. R. Bishop, Long Beach, $75,848; Byerts & Dunn, Los Angeles, $78,347; Nick Perscallo, Los Angeles, $76,758; White and Wilberg, Santa Monica, $70,893; The Contracting Engineers, Los Angeles, $75,875; C. O. Sparks and Mundo Engineering Co., Los Angeles, $85,660; United Concrete Pipe Corp., Los Angeles, $76,692; W. E. Robertson, Los Angeles, $69,750; Griffith Co., Los Angeles, $72,749. Contract awarded to J. E. Haddock, Ltd., Pasadena, $67,337.30.

RIVERSIDE COUNTY—About 8 miles southeast of Indio, two reinforced concrete bridges, one across Coachella Valley storm drain, consisting of thirteen 30-foot spans and two 9-foot cantilever spans and one across a drainage ditch, consisting of two 29-foot 4-inch spans and two 8-foot 8-inch spans. District XI, Route 187, Section F. R. E. Hazard & Sons, San Diego, $40,639; V. R. Dennis Construction Co., San Diego, $40,963; Valley Construction Co., San Jose, $44,404; Donald E. Metzger & Ralph A. Bell, Los Angeles, $46,359; The Contracting Engineers Co., Los Angeles, $46,683; Dimmitt and Taylor, Los Angeles, $50,307; United Concrete Pipe Corp., Los Angeles, $52,772. Contract awarded to W. E. Robertson, Los Angeles, $38,614.25.

RIVERSIDE COUNTY—Bridge across Temecula Creek about 7 miles east of Temecula consisting of reinforced concrete girder spans supported by reinforced concrete piers on precast concrete piles. District VIII, Route 78, Section B. United Concrete Pipe Corp., Los Angeles, $44,425; S. A. Cummings, San Diego, $44,767; H. H. Peterson, San Diego, $46,296; White and Wilberg, Santa Monica, $47,070; W. E. Robertson, Los Angeles, $49,475; J. S. Metzger and Sons and Ralph A. Bell, Los Angeles, $49,544; Contracting Engineers Co., Los Angeles, $50,710; Gibbons and Reed, Burbank, $52,007. Contract awarded to C. F. Robbins, Los Angeles, $41,876.00.

SIERRA COUNTY—At Downieville, existing reinforced concrete bridge to be removed and disposed of. District III, Route 25, Section A. L. C. Seidel, Oakland, $5,-889; B. A. Howkins & Co., San Francisco, $5,811; George E. France, Colfax, $3,900; Fred J. Early, Jr., San Francisco, $4,251; N. M. Ball Sons, Berkeley, $4,095. Contract awarded to E. T. Lesure, Oakland, $3,510.00.

SONOMA COUNTY — Between Boiler Gulch and Miller Creek, about 0.8 mile to be graded, road mix surface treatment applied and culverts installed. District IV, Route 56, Section C.D. John Burman & Sons, Eureka, $49,247; N. M. Ball Sons, Berkeley, $49,522; Guerin Bros., San Francisco, $52,082; E. T. Lesure, Oakland, $58,-513; Pacific States Construction Co., San Francisco, $58,962. Contract awarded to Parish Bros., Eldridge, $47,480.

VENTURA—A reinforced concrete slab bridge across Sespe Overflow, about one mile west of Fillmore to be constructed and approaches to be widened. District VII, Route 79, Section B. Macco Construction Co., Clearwater, $45,636; Gibbons & Reed Co., Burbank, $46,403; Griffith Co., Los Angeles, $50,368; White and Wilberg, Santa Monica, $52,444; Oscar Oberg, Los Angeles, $53,334; The Constructing Engineers Co., Los Angeles, $53,940; C. O. Sparks & Mundo Engineering Co., Los Angeles, $58,-176. Contract awarded to Ralph A. Bell & Donald E. Metzger, Los Angeles, $44,863.00.

JOINT CONFERENCE HELD ON ROADSIDE IMPROVEMENT

The National Roadside Council, the Conservation Committee of the Garden Club of America, and the American Planning and Civic Association held a Joint Conference on Roadside Improvement, on November 15th and 16th in New York City, to serve groups of people who will sponsor legislation in the 1939 sessions of the State legislatures, for roadside improvement.

All officials and organizations planning to sponsor roadside legislation were invited to attend and participate in the sessions.

State Engineers Win in Welding Competition

(Continued from page 17)

for the safety and stability of the truss, but which do not contribute in any way to resisting the direct loads upon the truss, which are: the weight of the truss itself, the concrete roadway, and the moving vehicles using the bridge.

"2. Riveted members subject to a direct tensile pull must be sufficiently enlarged to allow for the reduction in their cross section due to rivet holes. A line of rivet holes across such a member materially reduces its ability to withstand loads, and the size of the members must be increased to make up this deficiency.

PERMITS "RESTRAINED ENDS"

"3. All welded connections are considerably more rigid than riveted connections and permit construction of "restrained ends," the term used by structural engineers to denote the ability of a connection to resist bending as well as a direct force. This ability to withstand bending is a very useful one and permits considerable economy in rolled beams used in the floor system by transferring approximately one-half of the bending stress at the middle of the beam to the support at each end. Welding was used to join the ends of the beams together in order that they could resist stress in the support in the manner described. A greater percentage of the beam is therefore used at its maximum strength than is possible by not making use of "restrained ends."

"4. Rolled beam sections were used for all truss members, thus completely eliminating the excess detail material. With butt welded connections into a joint detail of approximately arranged plates, a smooth connection between all truss members is secured. This type of connection not only provides a smooth transition of stress and high resistance to impact stresses caused by moving loads, but is also the ideal type of surface to paint and maintain. Rivet heads and lacing bars are notoriously weak in holding a film of paint, and most maintenance costs after first general painting go to touching up those spots. This type of construction also eliminates water pockets and recesses difficult to paint or maintain.

CHANGE OF METHODS

"5. Erection methods are changed somewhat with the welded truss, but should actually be more economical than usual riveted truss erection as the truss members are assembled on the ground into a flat position on timber blocking at a convenient height for working. After assembly and welding of all truss members in their correct positions, the truss is raised to a vertical position and placed on the bridge pier. When both trusses are in place erection of the floor system and bracing members proceeds in the usual manner, using two erection bolts at the end of each piece. The connections are then butt welded together and the bolts removed.

"Electric welding procedure today is conducted on a scientific basis. Methods of welding, preparation of surfaces, types of electrodes, and generator equipment are available for any type of work. Bridge structures have lagged behind other fields of endeavor in development of designs and construction methods to take full advantage of the welding process. This situation is largely due to the initial heavy investment in shop equipment to fabricate riveted structures. Other contributing factors are lack of job organization by the general contractors to do this type of work and lack of adequately trained welders and welding inspectors."

In Memoriam

JAMES HARVEY RUST, Highway Maintenance Superintendent in District II, Division of Highways, passed away in Susanville on September 5, 1938, after an illness of short duration.

Jim Rust, as he was known to his associates, was born at Mandan, North Dakota, on October 26, 1883. During his early years he served the Great Northern Railroad as a telegrapher, but at the age of twenty-one he came to the west coast to try his fortunes in the Pacific Northwest. The greater lure of California later claimed him, and he moved to this State where he spent the last twenty-five years of his life. Prior to entering State service he was engaged in work connected with gold dredging in Northern California. In January, 1928, he became an employee of District II, and during the ensuing years advanced to the position of Highway Maintenance Superintendent, which he occupied during the past three years.

On October 14, 1911, he was married to Reta Alma Wright, daughter of an old Shasta County family. Surviving him are his widow and three daughters—Hannah Grey and Alma Rust of Oroville and Anna Smith of Red Bluff.

Jim Rust was admired both by his superiors and his subordinates, and his passing will be mourned, not alone by his family and friends, but by his associates in the State's service.

Eliminating Newhall Tunnel Bottleneck

(Continued from page 6)

side of these will be 11-foot strips of Portland cement concrete pavement with 7-foot plant-mixed shoulders. For the portion on the Mint Canyon Short Cut proper over which traffic will be somewhat lighter, there will be 33 feet of plant-mixed surfacing (three traffic lanes) with 8-foot oiled shoulders.

The whole Mint Canyon Short Cut is being built on up-to-date standards which will effect a very large saving to traffic using the highway. Using a conservative estimate of four thousand cars per day as average for 365 days during the year, we have 1,460,000 car trips over this highway per year.

Using three cents a mile as the cost of operation for the average car, which is extremely conservative since this includes trucks and buses as well as passenger cars, the saving in length of 5.4 miles would effect a saving of 16.2 cents per car trip. This, multiplied by 1,460,000 car trips per year, would indicate a saving to traffic of $236,520 per year or enough to pay for the entire cost of the project from Tunnel Station on San Fernando Road to Solamint on the Mint Canyon Highway in less than four years time.

Thus the gasoline tax money invested in this project will not only be used to construct a much safer and less congested highway over which to travel but will actually repay its cost to users of the road in an amazingly short time.

STATE OF CALIFORNIA

Department of Public Works

Headquarters: Public Works Building, Twelfth and N Streets, Sacramento

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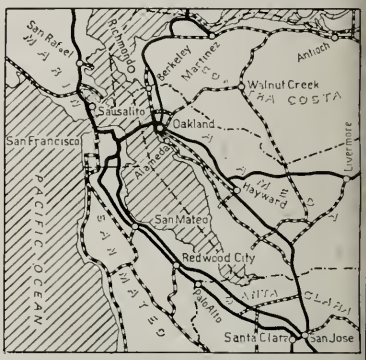
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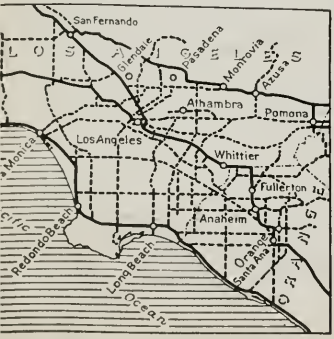
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MAP
SHOWING
STATE HIGHWAY SYSTEM

LEGEND
Primary Roads
Secondary Roads
Proposed Roads



SAN FRANCISCO AND VICINITY



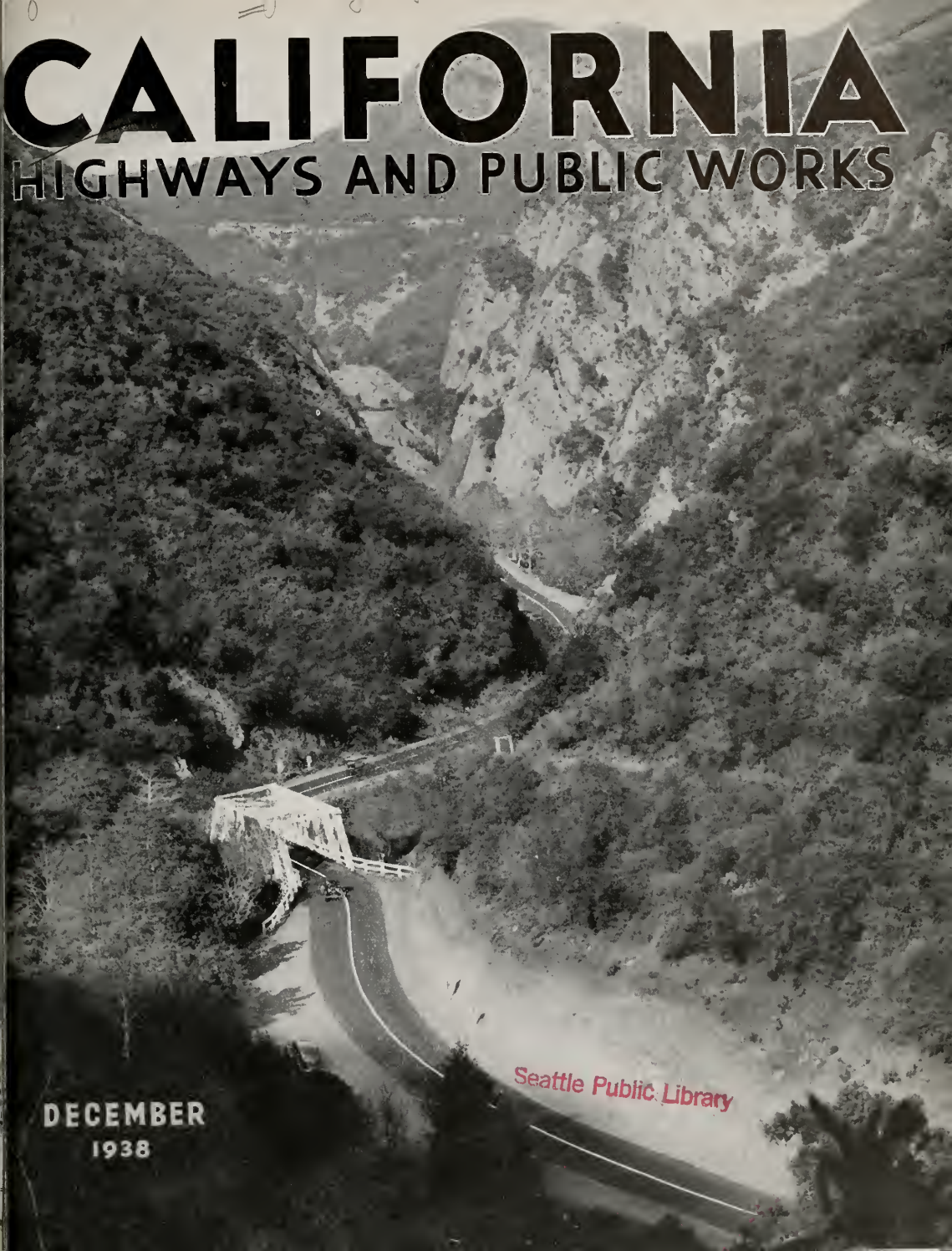
LOS ANGELES AND VICINITY

See Detail Map

See Detail Map

Seattle Public Library

CALIFORNIA
HIGHWAYS AND PUBLIC WORKS



Seattle Public Library

DECEMBER
1938

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways of the Department of Public Works, State of California

EARL LEE KELLY, Director C. H PURCELL, State Highway Engineer JOHN W. HOWE, Editor K. C. ADAMS, Associate Editor

Published for information of the members of the department and the citizens of California

Editors of newspapers and others are privileged to use matter contained herein. Cuts will be gladly loaned upon request.

Address communications to California Highways and Public Works, P. O. Box 1499, Sacramento, California.

Vol. 16 DECEMBER, 1938 No. 12

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Increase in Vehicular Transportation and Population in District VII Creates Complex Highway Situation

By S. V. CORTELYOU, District Engineer

Congestion of Traffic Big Problem

THE very large and rapidly growing metropolitan area of which Los Angeles is the center, is included in District VII of the State Division of Highways, and presents one of the most difficult and perplexing highway problems to be found anywhere in the United States.

The district is comprised of Ventura, Los Angeles and Orange counties, and includes:

42 % of the population of the state;
44.5% of the registered motor vehicles of the state;
40.2% of the assessed valuation of the state;
44.3% of the value of crop production;
37 % of the total value of manufactured products of the state.

District VII includes 62 incorporated cities. Within this area the industries and activities of the population are many and varied. Los Angeles, Orange and Ventura counties rank Nos. 1, 3 and 12 respectively among the counties of the entire nation in value of agricultural products, according to the 1930 federal census.

The agricultural industry in the district, although large and important, approximating a value of $171,000,000 per year, has been surpassed by the rapidly and constantly growing manufacturing industry, the total value of which per year is now five times the value of all agricultural products of this area.

The Port of Los Angeles has for many years been undergoing improvements, and is handling an increasingly large tonnage of freight. This tonnage has increased to such an extent that during the year 1937, according to figures furnished by the Maritime Commission, it stood first among ports of the entire United States for intercoastal shipping, actually surpassing the Port of New York by a narrow margin in this respect.

A total of 4,249,322 long tons of freight, exclusive of petroleum products (which are handled by pipeline) were handled in and out of this port last year. Of this enormous tonnage, approximately 70 per cent was handled by truck, imposing an extremely heavy burden on highway transportation facilities.

A large proportion of the agricultural products and oil produced in the surrounding country is shipped through this port, and correspondingly large quantities of incoming freight are distributed in Los Angeles and tributary country.

There is a tremendous interchange of freight, not only between the various parts of Ventura, Los Angeles and Orange counties and the Port of Los Angeles, but with the Imperial Valley, the agricultural region east of Los Angeles, and the southern portion of the great San Joaquin Valley.

So great is the interchange of freight between the San Joaquin Valley and the Port of Los Angeles, that the Ridge Route, which is the main connecting highway, now carries the greatest tonnage of freight of any highway in the western portion of the United States.



Intersection of Olympic Boulevard and Santa Fe Avenue in the city of Los Angeles. This is a typical midday traffic scene at this point. Olympic Boulevard is State Highway No. 173 extending through the city.







Top—Scene on Coast Route, State Highway 60, north of Santa Monica, which carries a daily average traffic of 10,000 to 15,000 vehicles and more on holidays. Center—Timber truss bridge across Rio Hondo River on State Highway 172, near Montebello oil fields, Los Angeles County. Bottom—Sharp turn at bridge on State Highway 138 between Maricopa and Ojai.

An increasingly large portion of the freight transportation in this area and surrounding areas is being handled by motor truck, and the State Highway system which forms a primary network of connecting highways carries the large burden of providing adequate transportation facilities between the various points. On account of the unusually heavy percentage of truck traffic, the greater portion of the highways must be designed with high type surfacing and correspondingly strong bridges to carry the load imposed upon them.

The mere fact that District VII contains 42 per cent of the population of the entire State does not begin to give a true picture of the traffic problem that faces the State Highway Department in this territory. During the decade from 1920 to 1930, which is the latest period for which authentic data are available (U. S. Census, 1930), the population of the entire State increased by 65.7 per cent, while the population of the area comprising District VII increased by 132.1 per cent, or more than double the percentage increase of the State as a whole.

Although authentic data relative to present population are not available, it has been estimated by competent authorities that the coastal plain of 1235 square miles immediately surrounding Los Angeles will, by 1950, have a population approximating 6,500,000, with a corresponding increase in motor vehicle registrations.

Real estate values are rising rapidly and may be expected to continue to rise with the rapid increase in population. This is very important from a highway standpoint, because of its effect on the cost of acquiring rights of way for highway improvements. The foregoing facts form a necessary background in considering present and future highway improvements for this area.

District VII has a total mileage of 1411.6, of which 299.5 miles are pri-







Top—Narrow winding road and one way bridge on State Highway over San Marcos Pass in Ventura County. Center—Short sight distance and many sharp curves on State Highway through hills near Ventura-Santa Barbara County line. Bottom—Narrow, steel, through-truss bridge over Piru Creek between Santa Paula and Ventura which carries much heavy traffic.

mary highways in unincorporated areas; 164.76 miles are primary highways within incorporated cities; 694.1 miles are secondary highways within rural districts; and 259.45 miles are secondary highways within incorporated cities.

The primary highways are the portion of the original State Highway System which connected the county seats of all counties of the State in one network. The so-called secondary highways are other additional roads, part of which were built by the State and part by the counties, and which were subsequently taken into the State system.

Together the primary highways and the secondary highways form the principal network by which traffic moves in various directions within the district. The fact that some are classed as "Secondary Highways" does not necessarily mean that they carry less traffic than the primary roads, as many "Secondary Highways" are listed among the most heavily traveled highways in the State system.

This system supplements a network of city streets and county highways for handling local traffic. The volume of traffic for the combined three counties, including that handled by city streets, county highways and State highways, is 46.6 per cent of all traffic in the State. Thirty-one per cent of all the traffic in the three counties is carried by the State Highway System.

Practically the entire network of streets and roads within the metropolitan area is now overcrowded with traffic, and when one attempts to conceive of a State Highway System adequate to carry the traffic demands imposed upon it, one must realize that immediately after a State highway is widened or otherwise improved, traffic formerly handled on adjacent roads and streets is attracted to the new improvement, thus overtaxing it from the start and rendering it inadequate

for the increased traffic which it is required to carry.

Not only is each new improved portion of the highway required to carry a greatly increased traffic, but owners of abutting property, realizing the commercial value of the improvement, immediately build up businesses which in turn require zoning for lower speeds, thus tending to cut down the traffic capacity of the highway.

An inventory of the present District VII system indicates the following mileages and percentages of the various types of surfacing of the rural highways now in use:

60 miles or 6% oiled and of inferior standards;
171 miles or 17% of intermediate type gravel and oiled;
124 miles or 12% of plant-mixed or macadam of intermediate standards;
9 miles or 1% of bridges;
642 miles or 64% of Portland cement concrete or asphaltic concrete of high type surfacing.

The fact that 64 per cent of the rural highways now have a high type of surfacing does not mean that they are in every way adequate for present day traffic requirements. Many of them were built years ago on inferior standards of alignment and grade. Many are too narrow to carry the traffic, and there are a great many highways and railroads intersecting at grade which endanger, delay and congest traffic.

In addition to the mileage shown above of rural highways, there are 424 miles of State highways within incorporated cities. In nearly all cases these highways are too narrow to accommodate present day traffic, and with the maze of intersecting streets and railroads and restricted speed limit zones, there exists in District VII one of the most difficult traffic problems to be found anywhere.

Of the 1411.6 miles of highways within District VII, 667.5 miles are multiple-lane highways as indicated by the following tabulation:

Rural
No. of Lanes

3	4	6	Div. 4	Total Miles
201	97	3½	20	321½

Municipal
No. of Lanes

3	4	6	Div. 4	Div. 6	Total Miles
51	236	48	4	7	346

$800,000,000 Estimate for District VII

The Automobile Club of Southern California, together with other civic organizations in Los Angeles and vicinity, have recently estimated that a complete new system of motorways which would in effect be freeways extending in various directions from the business district of Los Angeles would cost in the neighborhood of $800,000,000.

This estimate of $800,000,000 is mentioned in order to show that the estimate of $100,000,000 to bring existing highways in District VII to adequate standards as detailed in this article by District Engineer Cortelyou is in fact most conservative.

This estimate of $100,000,000 should be regarded as a minimum amount because there would still be required a very large annual expenditure to maintain and to enlarge such a system in order to keep pace with the ever-increasing traffic demands.

The total number of miles of highways within District VII does not give a true indication of the maintenance requirements since it includes a large portion of multiple-lane highways which if reduced to an equivalent length of two-lane highway would amount to a total of 2031 miles of two-lane roads.

The estimate of required expenditure, that follows, does not take into consideration the fact that as soon as any portion of this highway system should be improved, traffic now using other streets and highways would immediately use the new improvement, thus again making it inadequate for the volume of traffic it would be required to carry. Neither does it provide wide rights of way for future construction on our present system, which would be very desirable at this time to protect our present highway investment before land values increase to such an extent as to make their cost very much greater.

The estimate provides for two freeways which in general follow present State Highway routes, but does not provide for an adequate system of freeways radiating from the business center of Los Angeles in all directions, without which no transportation system in a metropolitan area similar to this could be considered complete. At the present time at least six such freeways are badly needed, and their cost would far exceed that of all other highway expenditures in the district combined.

Considering the present State Highway System in District VII, the following expenditures would be required to bring it up to adequate standards for handling the amount of traffic it is now called on to carry and to provide safety for traffic:

168 miles widen 2 lane to 3 lane pavement	$8,338,000
112 miles widen 3 lane to 4 lane pavement	5,526,000
214 miles reconstruct 2 lane pavement	9,207,000
7 miles reconstruct 3 lane pavement	188,000
63 miles reconstruct 4 lane pavement	8,670,000
67 miles construct new 2 lane pavement	4,389,000
8 miles construct new 3 lane pavement	319,000
31 miles construct new 4 lane pavement	4,370,000
37 railroad grade separation structures	8,976,000
36 highway grade separation structures	8,610,000
Bridges — New and reconstructing	2,850,000
Sea shore protection	1,050,000
60 miles of freeway construction, including R/W and grade separation structures	36,000,000
Miscellaneous minor improvements	1.560,000
	$100,053,000

A freeway may be described as a highway through a built-up area from which all vehicular access to abutting property is cut off and on which there are no intersections at grade of either highways or railroads, thus permitting the free and uninterrupted flow of traffic in either direction. Facilities for cars entering or leaving a freeway are only provided at convenient intervals and always without left turns across moving traffic.

To serve their purpose freeways must be divided multiple-lane roads of sufficient width to provide safety for traffic and to carry the traffic burden imposed upon them without



Photo courtesy Automobile Club of Southern California

Evening rush hour traffic scene at intersection of Fletcher Drive and San Fernando Road in Los Angeles. Both are State Highways with an average daily traffic count of 15,000 to 25,000 vehicles

undue congestion. In all cases where the construction of a freeway is justified, traffic must necessarily be exceedingly large, requiring very wide rights of way for the highway proper with additional widths on each side to provide for service roads to accommodate abutting property.

In cases where right of way is acquired for freeways, it is necessary to proceed on a minimum width of 90 feet, providing no service roads are required for handling local traffic adjoining the freeway. However, in cases where service roads are required, it will be necessary to secure a minimum width of 170 feet and a maximum width of 200 feet, to which must be added the additional required width for accelerating and decelerating lanes at side street intersections, and, where grade separations will be made, for the acquisition of the necessary right of way along both sides of the abutting streets for some distance back from the freeway proper.

The width of right of way depends on whether full clover-leaf or compressed clover-leaf intersections are desired for connecting the freeway in these locations with the abutting service streets and the connecting roadways to the intersecting highways.

The highly developed character of the territory which such proposed freeways traverse, makes the cost of acquiring rights of way very great. Development of the entire area is proceeding very rapidly with an increasing number of subdivisions springing up in the direct path of proposed freeways, thus constantly increasing the cost of acquiring right of way. Although securing right of way for a freeway would be costly even at the present time, it will undoubtedly be much greater as time goes on.

Detour Parallels Construction Job

ONE of the considerations on a reconstruction project is to take care of traffic adequately from the time the existing road is torn up until the work is completed and the new road thrown open to travel. This problem has been nicely handled on the grading and paving contract, 2.3 miles in length, being finished between Roseville and Rocklin in Placer County.

As soon as the necessary grade widening was completed, a road-mix detour was constructed of the native materials approximately 1½ inches thick and 20 feet wide, the old pavement being used, meanwhile, to carry the traffic. Upon completion of the detour, it was thrown open to traffic. The existing pavement was then removed, the area graded, and the placing of the portland cement contrete pavement was quickly started.

This detour, cheaply constructed and with no asphaltic seal, has held up remarkably well since given over to traffic on September 22d, and at the time of writing, according to Resident Engineer Remington, there has not been a single accident, even though it closely parallels construction for the greater part of the project.

Since the last official summer traffic count shows this highway as carrying from 4285 to 6300 cars daily, the record, both from a traffic and engineering standpoint, speaks well for those having the project in charge.

Lawyer: "Then you admit that you struck the plaintiff with malice aforethought?"

Defendant, indignantly: "You can't mix me up like that. I've told you twice I hit him with a brick, and on purpose. There wasn't no mallets nor nothin' of the kind about it—just a plain brick like any gentleman would use."



Section of new four-lane divided highway through Cuesta Pass. Center parting strip is unfinished and traffic striping yet to be done.

LA CUESTA REALIGNMENT OPENED, 59 STEEP CURVES ELIMINATED

By LESTER H. GIBSON, District Engineer

LA CUESTA, the steep and tortuous grade that since the days of the Franciscan friars has been the bogey of travelers on El Camino Real, no longer will impede the flow of motor vehicle traffic over The King's Highway.

Modern engineering skill at last has conquered Cuesta Pass on U. S. 101, midway between San Francisco and Los Angeles, eliminating the three score and more steep and hazardous curves on the Coast Highway where it winds through the Santa Lucia Mountains just north of San Luis Obispo.

The new divided four-lane highway through Cuesta Pass, constructed by the State Division of Highways at a cost of $1,050,000 to replace the old and dangerous road that originally was the Trail of the Padres, was officially dedicated to public service by Governor Frank F. Merriam on Saturday morning, November 5.

Pageantry, speechmaking and banqueting highlighted a two-day celebration hailing the opening of the new highway.

Standing on the spot where General Fremont camped with his troops on his march south to complete his conquest of California, Governor Merriam, wielding an ancient, hand-forged knife from the Mission San Luis Obispo, severed a rawhide riata stretched across the newly completed highway.

"This road opening is different from any I have attended," the Governor said, "in that I am using this old knife from your famous mission to cut the rawhide rope barrier. It makes this an especially romantic occasion and from it we should draw a lesson of progress and realize that Californians enjoy more blessings than any other people in the world. We should be grateful for these blessings and let this occasion be an inspiration for greater attention to maintaining and increasing them.

"I am happy to be present and to open this highway for the safe and happy travel of the thousands who will travel over it."

(Continued on page 8)



Top view shows wide roadbed and easy grade of new Cuesta Pass Highway providing 4 plant-mix surfaced traffic lanes separated by 4-foot dividing strip as yet unfinished and unstriped. At bottom, construction scene on huge fill that required moving 122,000 cubic yards of dirt.



At top one of the many steep, sharp curves on the old, narrow, La Cuesta road with traffic held up behind slow vehicles. Bottom scene gives general view of old winding grade.

The dedicatory ceremonies were opened by Claude Arnold, chairman of the San Luis Obispo County Board of Supervisors, president of the Mission Trails Association and chairman of the celebration committee. He introduced Senator Chris N. Jespersen of Atascadero, who presented speakers including H. R. Judah, chairman of the California Highway Commission, and Harry A. Hopkins, Assistant Director of the State Department of Public Works, who spoke for Director of Public Works Earl Lee Kelly.

FIRST USED BY PADRES

The ingenuity of man devising and improving modes of travel has required continual improvement of facilities for the use of ever changing modes of travel. Since founding of the Mission of San Luis Obispo de Tolosa by Padre Junipero Serra in 1772, Cuesta Pass has seen many a changing picture: first, Franciscan Fathers, Spanish courtiers, soldiers, mail carriers and brigands traveling by primeval trail; then, traveling by such road as nature offered, immigrant wagons; and in 1855 two-horse stages, later supplanted by six and eight-horse stages. Many were the passengers of these early stages who had reason to remember the arduous ascent of Cuesta Pass as they were required to work their way, in addition to paying a good price, by pushing the stage up hills and holding it from upsetting on sideling places.

Issuance of $20,000 worth of bonds in 1876 for constructing Cuesta Road over the Santa Lucia Mountains made possible the replacement of the winding road carved out by wagon wheels and pounding hoofs along the creek bottoms and up over the pass. Completion of this road, modern for that time, was acclaimed by all, as permitting one to travel with comparative ease over the once arduous pass. This road, though steep and narrow, is still traversable on the southern ascent where it winds along the precipitous westerly slope of San Luis Obispo Canyon.

ADVENT OF AUTOS

The advent of automotive transportation again changed the picture and shortly after formation of the first California Highway Commission in 1912, the problem of providing a road across this barrier adequate for the latest mode of transportation was presented. While the existing road was considered one of the best mountain roads in the southern part of the State, it was hardly suitable for adoption as a link in the main coast highway between San Francisco and Los Angeles.

Surveys were made and a contract let late in the Fall of 1914 for grading and surfacing a 24-foot roadbed with gravel along the easterly slope of San Luis Canyon. Thus, on completion of this contract in 1915, there came into being the highway over which traffic, until recently, wound its way over La Cuesta. The follow-

ing year an oil surface was provided which was maintained until 1922 when a 20-foot width of 6-inch concrete pavement, with a curb on either side, was constructed.

Again man had failed to perceive the developments his ingenuity would effect in the modes of transportation. With an ever growing increase in vehicles, particularly in the number of ponderous long trucks with trailers or semitrailers that moved slowly over the winding grades on both sides of Cuesta Pass, a once modern highway became obsolete, impeding the flow of traffic. Passing on the old two-lane road was hazardous and usually impossible in this day of speed, making the fast automobile traffic adopt the slow creeping pace of the large heavily laden trucks.

It was a frequent sight to observe a line of 20 or more automobiles creeping along behind a large truck throughout their crossing of Cuesto.

TRAFFIC CONGESTION

Once again the Santa Lucia Mountains became a barrier to transportation by reason of this serious traffic congestion which was rapidly becoming more acute. With appropriation of funds by the California Highway Commission at its meeting on January 3, 1936, for the reconstruction of 3.28 miles of highway over La Cuesta between San Luis Obispo Creek and Cuesta Siding, surveys and exhaustive studies were immediately undertaken.

Designing a highway with a construction cost that could be economically justified, that would ascend the southerly slope in a restricted distance without an excessive grade on flat sweeping curves, that would be stable along a steep canyon slope known to be generally unstable and would adequately and safely serve the mixed traffic of today and tomorrow, presented a real engineering problem.

The unusually large number of heavily laden trucks creeping over Cuesta in coastal transportation predominated traffic. This type of traffic created a serious traffic congestion and dictated that reconstruction provide four traffic lanes with a neutral strip to separate opposing traffic for safety alone. Constructing a roadbed of sufficient width to provide these traffic lanes over steep terrain requires cuts and fills of unusual magnitude. Results of preliminary surveys and exhaustive studies dictated a location following along the same side of the canyon as the existing road south of the summit and the opposite side of the canyon from the existing road north of the summit, with an overhead crossing of the Southern Pacific Railroad.

With the location and size of the cuts and fills determined, it became necessary to definitely ascertain the geological structure, what materials would be encountered in excavation, if they were stable or would be subject to slides, and if the soils found under the embankments would afford foundations for fills of such magnitude.

Under supervision of the Division of Highways Materials and Research Department extensive soundings were



Parking spaces are provided at appropriate places on the La Cuesta realignment. Striping and finishing of center dividing strip remain to be done.

made and samples taken, generally with soil tubes of their own design which obtained a continuous core. At a few locations where investigations to depths greater than possible with a soil tube were necessary, borings were made with a well drilling rig. From the information thus obtained plans were formulated to preclude slides and correct unstable embankment foundations. Where unstable cut slope material was evidenced benches were designed in the slope to lessen the load, or the slope flattened from the customary 1:1 to as much as $1\frac{1}{2}$:1, the usual angle of repose for soils. During construction some of the cut slopes were flattened to as much as 2:1.

DRAINAGE PROBLEM

Correcting the unstable fill foundations was yet another problem. The seepage found in each ravine served to saturate and lubricate the heavy mantle of soil covering the ravines making them very unstable. To dehydrate these areas and provide permanent drainage, a system of trenches was designed consisting generally of a main 10-foot width transverse trench with laterals. These trenches were to be backfilled with 2 to 8 feet of rock which was to extend up the trench slopes. In addition, in the main trenches 8-inch perforated metal pipe was to be laid.

In what is known as Schoolhouse Canyon, where one of the largest fills of the project was required, a drainage trench system could not be used due to the comparatively level canyon floor and the fact that plastic clays highly saturated by an underground flow extended to a depth of 75 feet. After particular study and experiment, it was decided to sink about 300 sand wells or piles completely penetrating the unstable mass and connected with a system of drains at the natural ground level; the theory being that as the load is applied by placing the embankment a readily accessible outlet is provided for the water contained in the unstable mass, permitting a comparatively rapid lowering of the moisture content with early stability.

A year was consumed by the surveys, soil investigations, and studies to assure that all factors had been given due consideration.

The handling of traffic through construction of this magnitude was a major problem in itself. Traffic must go through safely and without interruption. No detours were available around the work nor was it economically feasible to construct them. Only a small portion of the existing road could be used as detours until construction was completed. Where construction destroyed the existing road, provisions were made for its use by traffic until at least half the width of the new roadway had been completed to grade and available to traffic.

HUGE EXCAVATION JOB

Construction operations were started June 15, 1937, with clearing and grubbing following closely by excavation of the fill treatment trenches which had to be completed post-haste to permit starting construction of the fills. Construction of the fill treatment was a fair sized project in itself, amounting to approximately $87,000. It was necessary for the contractor to excavate a system of construction roads to afford access for equipment and hauling rock backfilling material. This was quite an item due to the steep terrain and involved moving many free yards of earth.

In terms of money, excavation of the large cuts and construction of the adjacent embankments involved approximately 50 per cent of the total final contract payment. It is interesting at this time to compare the 89,000 cubic yards of excavation involved in constructing the existing road built in 1915 with the 1,365,000 cubic yards moved under this contract.

The maximum fill on the project contains 122,000 cubic yards, and, although only 350 feet long, it has

(Continued on page 17)

Salient Facts Concerning Cuesta Grade

First road was nothing more than a trail following along creek bottoms and up over the summit. This was later known as the "Padre's Trail." Existed until obliterated by present construction.

Mission San Luis Obispo de Tolosa established by Father Junipero Serra in 1772.

First stage over Cuesta in 1855—two-horse and later six- and eight-horse stages. The first day's journey by stage was to San Miguel.

Present county road south of summit along westerly precipitous slope constructed by bond issue of 1876 amounted to $20,000 for the purpose of making a road over Santa Lucia Mountains, to be known as Cuesta Road.

California Highway Commission let contract for grading old road along easterly slope late in fall of 1914. Completed in 1915. Total cost $58,771. Surface oiled in 1916 and maintained as such until 1922.

California Highway Commission let contract in 1922 for daylighting blind curves and constructing $21\frac{1}{2}$-foot reinforced concrete pavement with curbs along each side. Completed December 26, 1922, at a total cost of $169,166.

Funds for present construction voted by commission at meeting January 3, 1936, in the amount of $665,000 and at meeting of March 5, 1937, $280,000 additional was voted, making a total of $945,000.

Work started June 15, 1937. Total excavation involved, 1,365,000 cubic yards.

Maximum fill on project contains 122,000 cubic yards; though only 350 feet long it has a maximum height of 170 feet.

There are two cuts of particular note, one containing 190,000 cubic yards and the other 210,000 cubic yards.

Roadway consists of two 21-foot lanes surfaced with plant-mixed surfacing on crusher run base divided by a raised 4-foot parting strip. The width of roadbed is 52 feet.

Reinforced concrete overhead crossing of the Southern Pacific Railroad, constructed under supervision of Bridge Department of Division of Highways. Approximately $100,000 expended on this portion of the project.

Total cost of project including preliminary engineering, moving utilities, construction of overhead and road will approximate, $1,050,000.

Comparison of old and new roads:

	Old	*New*
Length	4 miles	3.283 miles
Roadbed width	24 feet	52 feet
Number of curves	71	12
Minimum radius	60 feet	800 feet
Average grade	6.222%	7%
Minimum vertical sight distance	275 feet	440 feet
Unimpeded safe driving time	10 min.	5 min.
Driving time required	10 to 45 min.	5 min.



Realignment of U. S. 101 through San Rafael near Grand Avenue has four traffic lanes with painted dividing strip—Service road at right.

San Rafael Bottleneck Broken

By W. A. RICE, Resident Engineer

ONE of the worst "bottleneck" impediments to traffic on the entire California Highway System was removed on Sunday afternoon, November 13, when Governor Frank F. Merriam officially opened the $400,000 realigned San Rafael-Ignacio Highway.

Officials of the State, Marin County, the Redwood Empire Association and civic bodies of Marin participated in a celebration held at the top of Puerto Suello Hill. Symbolical of the occasion, a huge papier mache bottle blocking the highway was torn in half when the Governor joined a group of students of San Rafael schools tugging on a long rope attached to the neck of the blockading bottle. This ceremony was part of a pageant depicting the various steps in road building from the days of the Padres who established Mission San Rafael to the present.

The realignment of U. S. 101 through San Rafael was made necessary by the steady increase of traffic between San Francisco and the Redwood Empire following completion of the Golden Gate Bridge.

Studies of this growing traffic showed that the most constricted section of U. S. 101 between the Golden Gate Bridge and Santa Rosa was from Ignacio through San Rafael. On the old two-lane pavement, traffic on the seven-mile stretch between these two points reached an intensity of 1700 cars for a one-hour period with a sustained flow of 1250 or more per hour over an eight hour period. Sunday traffic in the summer months of June and July approximated 18,000 vehicles per day and week-day traffic often exceeded the carrying capacity of the highway.

Maximum congestion occurred in San Rafael where numerous intersecting streets, stop signals and grade crossings prevented a free flow of traffic. It was decided to fully improve a new half mile section from the north city limits of San Rafael to Grand Avenue from which point one of the future routes contemplated can be continued.

HEAVY TRAFFIC CONGESTION

The entire San Rafael-Ignacio project, 7.5 miles long, a vital link in the Redwood Highway, was inaugurated primarily as an aid in handling peak vacation traffic. The old two-lane road from the junction of the Black Point Road, to San Rafael, proved to be totally inadequate to allow the unimpeded flow of traffic, especially during the week-ends when summer traffic was practically all homeward bound.

There were times when southbound traffic was congested from

San Rafael to Petaluma, and it took from three to four hours to cover those 20 miles. This was caused mainly by restricted flow of traffic through the town of San Rafael, where speed limits and numerous intersections caused much traffic interruption with the consequent backing up of traffic over long distances of the road.

The southern portion of the project was constructed in San Rafael and consisted of a 50-foot plant-mixed surfacing placed on a graded 90-foot roadbed. A service road was built and an underpass constructed to handle local traffic so that the previous constriction to the flow of traffic due to the numerous intersections might be avoided.

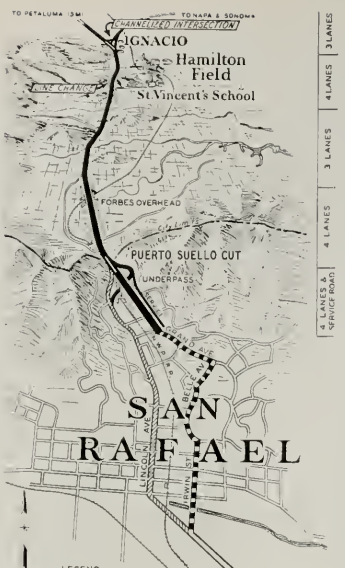
PROVIDE FOR FUTURE

From the northerly city limits of San Rafael to the Black Point Road the existing two-lane roadbed was widened to a graded 64-foot roadbed and surfacing placed thereon. Where sight distance was ample, and traffic could pass safely three lanes were provided. Where sight distance was restricted and where the greatest congestion occurred four lanes of pavement were provided.

The entire project was graded so that a fourth lane could be placed at all points. Several small bridges were widened and the overhead crossing over the Northwestern Pacific tracks at Forbes Station was widened to accommodate four lanes plus a division strip. This anticipated a further growth of traffic and provides that when it becomes necessary to widen the sections where three lanes are considered ample at the present time, it may be done with a minimum expenditure and without a loss of the present investment.

Where the existing surface was of Portland cement concrete, the widening to three lanes was accomplished by adding a 13-foot section of 5-sack concrete along the side of the existing 20-foot pavement. In placing this concrete surfacing every care was taken to make it a smooth even-riding surface. However, since the new pavement abutted directly against the old surface, in most instances considerable difficulty was experienced.

Where entirely new pavement was placed, as over St. Vincent's Cut,



Sketch map of realignment through San Rafael to Ignacio.

float finishing with the Johnson mechanized float gave a very good riding surface. Curing with impervious membrane eliminated ponding or other methods which would have necessitated keeping the road closed to all traffic for a longer period of time, thereby adding to the inconvenience of the public during the summer season. Where the existing surfacing consisted of oiled macadam the widening was done with plant-mixed surfacing.

A major line change was made over St. Vincent's Hill. Here several curves were replaced by two curves, the summit lowered by approximately 8 feet and four 11-foot lanes of concrete surfacing placed. An additional safety factor was incorporated by separating the opposing lines of traffic with a 6-foot dividing strip of plant mix.

From the junction of the Black Point Road to south of Ignacio the surfacing is sufficiently wide to allow for a painted 6-foot dividing strip. Over the Miller Cut, widening to 50 feet was done by placing a 13-foot strip on the east and a 17-foot strip on the west. This allows for a dividing strip to be painted on this section. Wherever transitions were made from a three to a four-lane road or vice versa, approximately 500 feet was allowed to permit traffic to accommodate itself to the changed roadway width.

MODERN SAFETY FEATURES

In the rebuilding of this road modern safety features have been incorporated. As already noted, the various opposing lanes of traffic have been separated by either a plant-mixed dividing strip or a painted one. In San Rafael, a Service Road was constructed with a plant-mixed surfacing to accommodate local traffic, making it unnecessary for it to encounter through traffic except at designated intersections and under controlled conditions.

An underpass was constructed to pass the traffic from the center of San Rafael along Lincoln Ave., under the new road and bring the vehicles into the main road headed in the same direction as the remainder of the traffic. This underpass also provides access to the Service Road, making it unnecessary for the local traffic to cross the main flow of traffic.

At the junction of the Black Point cut-off and U. S. 101, a channelization is being constructed. This will consist of widened accelerating and decelerating lanes defined by curbs and will serve to segregate and protect traffic at this point. By this channelization, traffic east and westbound over the Black Point Road will be separated, eastbound traffic being carried on one road, westbound on another, with access from the main road for Napa-bound south traffic. Acceleration lanes are provided for Black Point Road traffic southbound on U. S. 101 which will allow more ready assimilation into southbound traffic at times of peak loads, thus relieving another point where hazards and impeded flow have existed for years.

MORE WORK NECESSARY

Much remains to be done, particularly through San Rafael, before the full effect of this construction becomes operative in relieving traffic congestion and hazard but the problem has been attacked and we believe solved at the most critical point.

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Two views of the realignment of U. S. 101 in Marin County looking from Puerto Suello cut south toward city of San Rafael. Through traffic bound north and south is separated from local traffic by the grade separation in the middle distance and the service roads at the left. Lincoln Avenue is shown on the right of the top picture with local traffic bound north coming through the underpass and up the service road on the left to merge with through traffic. At right of lower picture may be seen a loaded truck entering the truck route on former routing into the city via Lincoln Avenue.

Widening of Rose Canyon Gives San Diego Modernized Gateway

By EARL E. SORENSON, District Construction Engineer

RECENTLY completed widening and modernization of the Rose Canyon gateway to San Diego will provide one of the finest approaches of any comparable city. Traffic can now enter the confines of the city and be distributed rapidly and directly to the industrial, shipping, military and business sections with a minimum of lost motion.

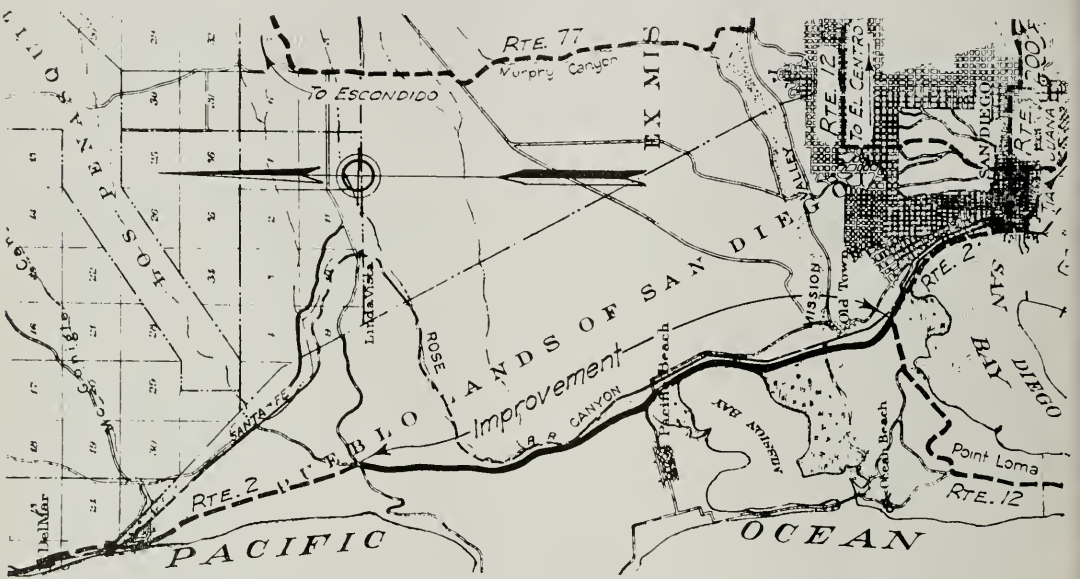
Prior to 1930, all traffic between San Diego and points north was routed through La Jolla, which lay some two miles west of a feasible and more direct line. Originally traffic, after leaving either the Torrey Pines Mesa or the Sorrento Canyon route, traveled down to the seacoast at La Jolla, over the steep and winding Scripps Grade, which present day large trucks would be unable to negotiate. This was later supplemented by the La Jolla Grade which was a great improvement over the older route and which adequately handled traffic for some years. At present, both these roads serve La Jolla, the Scripps Grade as a scenic drive and the La Jolla Canyon road as a more direct all-purpose route.

For many years prior to 1929, a connecting wagon road existed through what is known as Rose Canyon, a direct short route from Balboa Avenue to a connection with the La Jolla road at the south end of Torrey Pines Mesa. This road, although approximately five and one-half miles shorter, was unpaved, and in such condition that traffic preferred the longer route through La Jolla. As passenger and freight traffic increased between Los Angeles and San Diego, the need for improvement of the shorter road became imperative, and its construction was started in 1929 when a joint city and State project was arranged to care for the grading from Balboa Avenue to Torrey Pines Mesa.

The present completed highway from Barnett Avenue to Miramar Road, a distance of 9.7 miles, is the culmination of this and several other projects over the intervening years.

The first contract in 1929 provided for grading and necessary small drainage structures at a total cost of approximately $110,000. A concrete bridge costing approximately $27,000, over Rose Canyon Creek, was constructed during the same period under a separate contract. This completed the grading operations through the canyon proper, from Balboa Avenue to Miramar

(Continued on page 16)





Rose Canyon improvement looking north from Elvira Station showing new divided highway, long easy curves and safety features.



Curbing of center dividing strip has recessed panels painted to reflect light at night as an added safety design.



New divided highway through Mission Bay Park area of Rose Canyon widening project showing recessed paneled curb of parting strip.

Road, but provided no surfacing and was uninviting to both light and heavy traffic.

In 1930 a contract was awarded and completed for placing a Portland cement concrete pavement 30 feet in width and providing for three lanes of traffic over the portion graded in 1929.

The completion of the above project gave traffic a direct route to San Diego, but a congested one from Balboa Avenue south to the city proper.

The need for a new road from Balboa Avenue through the uncongested area at the head of Mission Bay, to carry traffic to lower Broadway and the Coronado ferrys, on Pacific Boulevard, was acute. This route, while closely paralleling the old Moreno Boulevard, lay across the Santa Fe tracks in undeveloped territory, which permitted economical development. It also discharged traffic directly into Pacific Boulevard at Barnett Avenue from whence it could be easily dissipated through the various city streets.

The need for the new route resulted in the awarding and completion of four separate contracts during the year 1933. These contracts provided for the grading and small structures over the entire length, the construction of reinforced concrete bridges over the Cudahy Channel and Tecolate Creek, both providing for four lanes of traffic, the construction of a reinforced concrete bridge over the San Diego River of the same width and the paving with asphaltic concrete for a width of 30 feet over the entire length. An approximate total cost of $347,000 was involved in these four contracts.

CONGESTION RELIEVED

The above work completed the road from Barnett Avenue to Miramar Road and provided a high standard minimum three-lane highway. It was anticipated that it would care for traffic for a considerable period of time. However, the unprecedented development and growth of the San Diego territory, together with enormous increase in the number of motor vehicles, resulted in congested and dangerous conditions before 1938, which necessitated even further development, and the project just completed provided for widening to a minimum of four lanes over the entire length of 9.7 miles.

The contract was awarded to the D. H. Ryan Company of San Diego on April 18, 1938, and the contractor, by excellent planning and timing of his work, together with efficient operation and some double shifting, completed the work in November, 1938, some five months ahead of schedule.

Due to heavy and fast traffic over this section of highway, the accident rate was high, and it was found advisable to separate opposing lanes of traffic by a fixed barrier consisting of raised curbs over the greater portion of the distance.

10-FOOT LANE ADDED

The design of the highway called for widening to a minimum of four lanes by the addition of a 10-foot lane to the existing asphalt concrete from Barnett Avenue north for a distance of two miles. From this point north to Balboa Avenue, the existing asphaltic concrete pavement was widened to 52 feet, permitting separation of opposing traffic lanes by raised curbs 6 feet apart and providing for interior traffic lanes of 12-foot width and exterior 11 feet in width.

From Balboa Avenue north an existing 30-foot concrete pavement was widened by the addition of 20 feet of Portland cement concrete which permitted a 4-foot separation of curbs, leaving interior and exterior lanes of 12 feet and 11 feet, respectively.

The most advanced theories of design were applied to these separating curbs, including sloping sides

(Continued on page 28)

La Cuesta Grade Opened, 59 Curves Eliminated

(Continued from page 10)

a maximum height of 170 feet. There were two cuts of particular note, one containing 190,000 cubic yards, the other 210,000 cubic yards.

GRADING PROGRESS NOTEWORTHY

Despite an unusually severe winter, suspending operations for the better part of three months, the grading progress is noteworthy, an average approximating 100,000 cubic yards per month having been attained. The maximum for any one month was 150,000 cubic yards working two shifts.

Thanks to the exhaustive soil survey, slides exceeded the anticipated number only slightly. Attributable to this also is the fact that fill treatments functioned as contemplated, serving to stabilize all areas in spite of the enormous loads placed thereon. Of particular interest was the successful functioning of the 300 sand wells or piles constructed in School House Canyon by driving a 16-inch hollow seamless mandrel 70 feet long through the clay strata and filling the opening with sand as the mandrel was extracted. While the embankment settled two feet after its completion there has been no late movement nor any upheaval of adjacent areas lending to the belief that early settlement and stability of this 60-foot embankment has been obtained.

CONCRETE OVERHEAD BUILT

Two 21-foot traffic lanes of plant-mixed surfacing on crusher run base separated by a raised 4-foot dividing strip are provided on a 52-foot width of roadbed. While the 3-foot plant-mixed surfaced shoulders do not permit vehicles parking clear of the traffic lanes, similarly surfaced turnouts or parking areas have been provided at frequent intervals.

As a part of this project a reinforced concrete overhead crossing of the Southern Pacific Railroad was constructed under a separate contract at a cost of $100,000. Design of this structure presented a problem, due to the small angle, 22 degrees, between the road and railroad. The structure



Grade separation in La Cuesta presented a problem due to small angle between road and railroad. Structure is 465 feet long with 50-foot roadway separated by curbed 4-foot division strip.

is a "rigid frame" type with parabolic arched girders and deck being continuous over several spans. It consists of 10 spans of various lengths and has a total length of 465 feet. A total roadway width of 50 feet is afforded divided by a 4-foot parting strip with concrete curbs on either side.

Completion of the project marks the end of two and one-half years of continuous work, approximately a year being required for surveys and studies, and one and one-half years for actual construction, at a total cost of $1,050,000 or $320,000 per mile.

There is a marked feeling of satisfaction to know that the road embodies all the safety features of modern engineering design and that the last traffic bottleneck has been eliminated from the main Coast Highway between Los Angeles and San Francisco.

The project was under the general supervision of the writer. V. E. Pearson was Resident Engineer and the contract was performed by the Metropolitan Construction Company.

Formal opening of La Cuesta was followed by a colorful celebration in the city of San Luis Obispo, where a two-mile Pageant of Progress attracted thousands of spectators.

On Friday night the county and city of San Luis Obispo were hosts to three hundred officials and civic leaders of California. Governor Merriam was the guest of honor and seated with him were Mayor Angelo J. Rossi of San Francisco and Mayor Fletcher Bowron of Los Angeles.

Welcoming addresses were made by Mayor L. F. Sinsheimer of San Luis Obispo, Chairman Arnold of the county board of supervisors, and Cecil G. Evans, president of the San Luis Obispo Chamber of Commerce. Brief talks were made by Governor

(Continued on page 28)

TWENTY-FOUR MILE PROJECT ON INTERSTATE ROUTE COMPLETED

By F. W. HASELWOOD, District Engineer

WITHOUT any ceremony, workmen removed the barricades at each end of the newly completed road between Cougar and Macdoel, on U. S. 97 in Siskiyou County on November 2d and an unending stream of traffic began the use of a newly completed link of an interstate highway of major importance.

This 24-mile unit of the Weed-Klamath Falls highway, is on a new location that reduces the distance by 7 miles, the summit elevation by 600 feet, and the safe traveling time by at least half an hour. The development of this route has been proceeding for several years. In view of the increasing use of this route, a brief resume of its present stage of development and its value to interstate traffic is offered.

In 1931 there was taken into the State Highway System, along with other roads then classified as eligible, a road from Weed on the Pacific Highway, to the Oregon line north of Dorris. This was designated as route 72 and is locally known as a part of the Weed-Klamath Falls highway.

This road is a key unit of an extensive highway system, the major portion of which lies in Oregon, of much greater importance than its local name indicates. At Klamath Falls this road connects with and becomes an integral part of an improved highway extending north to The Dalles and known in Oregon as The Dalles-California Highway. A connection from Maupin over the mountain south of Mt. Hood serves Portland and makes this route an excellent alternate to the Pacific Highway.

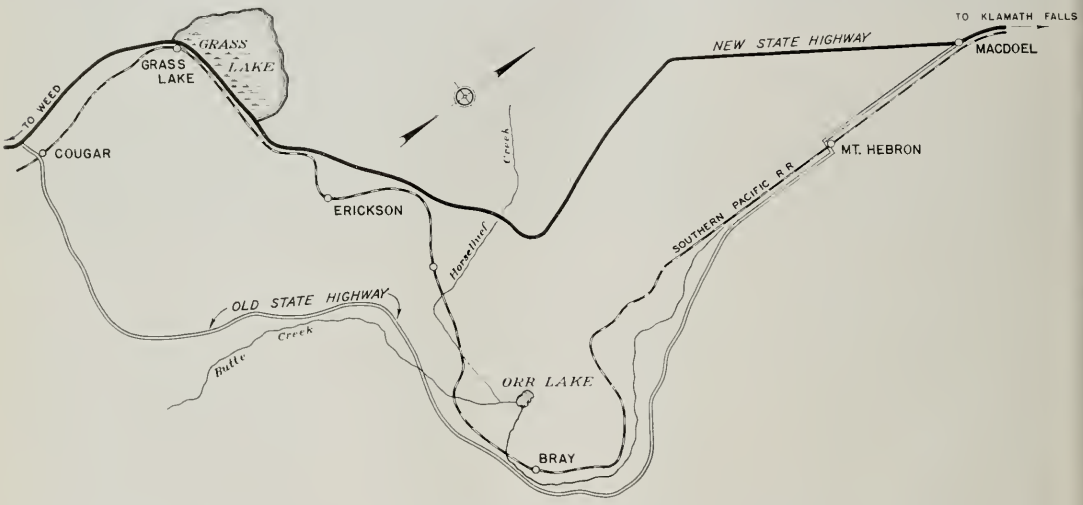
The comparative distances from Weed to Portland are, via Pacific Highway, 380 miles, and via Klamath Falls and Maupin, 411 miles. In spite of the handicap in distance, the route via Klamath Falls offers better alignment and grade and fewer summits.

For some time there has been under construction jointly by the State of Oregon and the Federal Bureau of Public Roads, a 73-mile connection between a point on The Dalles-California Highway about 10 miles south of Crescent and Goshen about 7 miles south of Eugene on the Pacific Highway. Comparative distances from Weed to Goshen on completion of this connecting route will then be, via Pacific Highway, 251 miles, via Klamath Falls, 234 miles.

Having in mind the relative importance of the Weed-Klamath Falls Highway as a unit of a major transportation system, both Oregon and California have been diligently improving the route as rapidly as finances permitted. In 1931, the distance from Weed to Klamath Falls was 63 miles in California and 21 miles in Oregon, a total of 84 miles of low standard, dusty, and, in California, mostly one-way county road.

In 1936 Oregon completed her portion of the route to a high standard of alignment, grade and surface, eliminating railroad grade crossings and

(Continued on page 20)





Views of recently completed portions of the Cougar-Macdoel sector of the Weed-Klamath Falls highway, U. S. 97, in Siskiyou County. The top and bottom pictures show long, straight stretches of the 22-foot bituminous mixed surface highway through rolling, partly timbered area. The center picture shows the route looking south across Wild Horse mesa with snow covered top of Mt. Shasta looming in the background.



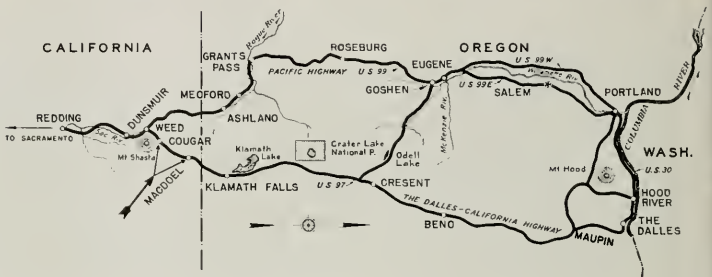
Tractors equipped with big rubber-tired wheels and weighted with bags of cement rolling soil-cement base construction.

reducing the distance from the State line to Klamath Falls to 17 miles.

In California the process has been somewhat slower but with the completion in October of a 24.2-mile unit between Cougar and Macdoel all but 1.4 miles of this road will have been brought to a high standard of alignment and grade, with an intermediate surface, serviceable and adequate for present requirements.

Immediately prior to the acquisition of this road as a part of the State Highway System, the Bureau of Public Roads and a joint highway district had graded 13 miles from 4 miles out of Weed to Cougar. The State's first move late in 1931 and early in 1932 was to improve grade and drainage on the remainder of the road to provide for two lanes throughout. The next move during the summer of 1932 was in accordance with established California practice to make the road dustless by the application of light oil.

The most difficult unit of the route from the maintenance point of view was about three miles from Dorris to the State line. This inferior earth road over poor soil quickly became impassable after light rainfall. In 1933 this three miles was constructed on new alignment and grade with a 6-inch base course of crushed rock and a temporary armor type of surface. About the same time the existing road between Dorris and Macdoel, 10 miles, was improved with a



Map showing relation of Cougar Macdoel improvement to interstate highway routes.

road mix of oil and local cinders.

In 1935 a permanent routing between Cougar and Macdoel was developed. This routing, via Grass Lake, is 24.2 miles long, as compared with 31.2 miles by the used road, via Bray. The estimated cost of a completed grade and standard intermediate type of surface consisting of a 6-inch base course and 2.5-inch bituminous-treated surface was $600,000. The impossibility of allocating any such sum from the State's finances for a secondary road in even two bienniums gave a gloomy prospect to any proposal for improvement of this unit.

CALIFORNIA FINANCED SECTION

However, in 1935 the Bureau of Public Roads approved an allocation of $150,000 from Federal Emergency funds for grading an initial unit of the road. The grading on this unit of 8 miles, a portion of which crosses the bed of Grass Lake, was completed in 1936, and the fact that it was not usable until the remaining 16 miles was constructed imposed an obligation on California to finance this remaining section as well as to provide a surface on the 8 miles already graded.

The route traverses a partly open and partly timbered area. All of the formations are of igneous origin, although there are sedimentary deposits of weathered igneous rock. The problem, as it presented itself, was to get a usable road completed between the termini on what was believed to be permanent alignment and grade, after which strengthening of the surface could follow as required without loss of any work that had been done.

Accordingly, an intensive study was made of the quality of material from which the grade would be built, and it was found on about 80 per cent

of the road to be uniformly high in stability. Frequent deposits of excellent fine cinders and fine gravel testing high for use in subgrade and base and also for use with oil were located. By virtue of these deposits of good local material, the Division of Highways proposed to complete the grading of the remaining 16.2 miles and oil treat a stabilized subgrade in a manner to serve traffic for several years, before any additional increments of surfacing were required, for $300,000.

The improvement of this 24.2 miles of road to a usable stage was completed November 2, 1938, at a total construction cost of $434,317.73, accomplished in three contracts, as follows:

1935—Dunn & Baker, Klamath Falls, grading 8 miles at a cost of $156,695.67.

1937—Harold Blake, Portland, Oregon, grading 16.2 miles at a cost of $178,920.95.

1938—Oilfields Trucking Company, Bakersfield, surfacing 24.2 miles at a cost of $98,701.11.

The grading done by Harold Blake was completed early in 1938, and, coincident with this completion, the work of surfacing was started.

The surfacing consisted of reinforcing the subgrade with applications of cinders or gravel at those locations where material in the grade lacked stability, it being the intention to bring the entire subgrade to a strength measured by saturated bearing value tests of 35 per cent. This subgrade for 21.2 miles was then primed with SC-2 oil at the rate of half a gallon per square yard, resulting in an average penetration of at least half an inch. On top of this a layer of pit run cinders, half inch minus, or screened gravel one inch minus, was road-mixed with ROMC-3, providing a bituminous mixed surface 1.75 inches thick and 22 feet wide. This mix is sealed with $\frac{1}{3}$ gallon per square yard of penetration emulsified 90-95 asphalt without cover. The quality of this local material for use with oil is such that tests show the stability of the mix to range between 45 and 50 and the swell to be .008 or less.

The northerly end of the project is in Butte Valley, across what was once a lake bed. The soil is a light, sandy silt deposited by water from weathered igneous rock. About the time this project was being developed the proposal to stabilize local soil with the addition of Portland cement was under consideration, and it was decided to use this method on the northerly 3 miles.

Experimental sections of soil-cement base had been constructed in 1937 in southern California by day labor, and the value of the process had already been demonstrated. The only experimental phase of the soil-cement construction on this project was the determination of the ability of a contractor to coordinate his equipment and organization to secure the proper timing of the various operations involved. The field work is comparatively simple and does not require any special high-priced equipment. It consists of loosening, pulverizing and moistening the grade to the depth to be treated, applying the cement, usually by hand-spreading from sacks at the specified rate, incorporating the cement in the soil by mixing with gang plows, disk cultivators and spring tooth harrows, adding additional moisture, compacting with sheepsfoot rollers and finishing with a blade and tandem or rubber-tired rollers.

The finished base which is 22 feet wide and 6 inches thick, is smooth and hard, having a high stability, and is comparable to an equal thickness of crusher run base.

Soil-cement bases have been used with and without bituminous treatment. On this project the base received a prime of $\frac{1}{4}$ gallon per square yard of SC-1A road oil and a one-inch thickness of road-mixed gravel, sealed with $\frac{1}{3}$ gallon of emulsified 90-95. The cost per mile of the completed base was $6,093, and of the prime, mix and seal $1,575, making a total cost of $7,668 per mile.

Bay Bridge Traffic Report Reveals New High in November

SAN FRANCISCO-OAKLAND BAY BRIDGE traffic during November climbed to a new high for 1938, it was revealed yesterday by Chief Engineer C. H. Purcell in a monthly traffic report filed with Director of Public Works Earl Lee Kelly.

Total number of vehicles to cross the bridge last month was 783,252, averaging 26,108 vehicles per day. This is an increase of 12% or an increase of 2800 vehicles per day over November, 1937. High point of the month was Saturday, November 19, the day of the Big Game, when 40,761 vehicles crossed the span.

Freight pounds, too, increased last month with a total of 115,921,750. This was an increase of 86% over November a year ago. Total number of trucks and trailers to cross the Bay Bridge in November was 41,503, a 60% increase over November, 1937.

Total revenues for November were $410,709.65, an increase of 11% over the same period last year. For the year 1938 to date 7,873,646 vehicles have crossed the bridge, bringing the grand total since the bridge opening on November 12, 1936, to 18,318,196 vehicles.

Comparative figures follow:

	Total November	*Total October*	*Totol since opening*
Auto Trailers	859	1,149	29,780
Passenger Autos	708,587	688,232	16,967,986
Motorcycles	2,461	2,677	63,534
Tricars	1,210	983	20,486
Buses	13,239	13,594	234,018
Trucks	39,760	39,384	680,056
Truck Trailers	1,743	1,653	37,972
Toll Vehicles	767,859	747,672	18,033,832
Auto Passes	13,767	13,720	258,832
Truck Passes	1,626	1,591	25,532
Total Vehicles	783,252	762,983	18,318,196
Extra Passengers	238,999	235,728	4,502,196
Freight Pounds	115,921,750	108,683,917	1,707,260,076

Railroad Grade Separations Completed on Rosemead Arterial

By E. L. WALSH, Assistant Bridge Construction Engineer

TWO railroad grade separations were completed last month on Rosemead Boulevard (State Highway 168) near the city of Los Angeles by the Division of Highways—one under the Southern Pacific tracks near Rudell Station, located one mile north of Rosemead, and the other under the Union Pacific tracks near Pico at Whittier Boulevard.

These structures on Rosemead Boulevard comprise two of the various construction units which have recently been completed as a part of the development of State Signed Route No. 19 as a through highway from Long Beach to Pasadena.

This route, extending from the connection with the Roosevelt highway (U. S. Alternate 101) at Long Beach to the Foothill Boulevard at Lamanda Park near Pasadena, was added to the State Highway System in 1933. At that time only portions of the route and locally known as El Cerritos Avenue and San Gabriel Boulevard were improved. The route is about twenty-six miles long and now comprises Lakewood Boulevard south of Rivera and Rosemead Boulevard to the north of Rivera.

DIVIDED HIGHWAY PLANNED

Skirting the most heavily settled areas of Los Angeles and adjacent communities, it provides a through and rapid means of communication among them. It connects at the north end with Colorado Street and the Foothill Boulevard via Altadena providing a direct route for through traffic from the north and east that wishes to avoid the congestion of metropolitan areas.

A modern four-lane, divided highway has been adopted for the improvement plans for this road in line with its growing importance. The future service is well predicted by the increase of traffic since its partial improvement by the State. In July, 1934, the greatest daily traffic count at any of four points was 6200 vehicles. In July, 1938, the maximum count at any of the same four points was 17,312 vehicles. It is estimated that within a few years the peak traffic count on this road will exceed 20,000 vehicles per day.

One feature of this route that has great bearing on its improvement is the considerable number of grade separations required to attain its maximum service and safety to the public. Extending as it does in a north and south direction, this route must necessarily intersect the numerous main arteries of rail and highway traffic that converge at Los Angeles from the San Bernardino Valley to the east and from the Orange County urban districts to the south.

RIVERA SUBWAY

Among the highway projects which have been completed within the last two years was the important railroad grade separation under the Santa Fe Railroad tracks near Rivera. The Rivera structure provides a separation of traffic between the highway and the double tracks of the Atchison, Topeka & Santa Fe Railroad. This project was completed in March, 1937, at a total cost of approximately $108,000. The project was located about ¼ mile west of Rivera and included 0.36 mile of highway improvement. The improved portion of the highway is 62 feet wide betwen concrete curbs, and has a four-lane Portland cement concrete pavement 40 feet wide. Plant-mixed bituminous surfacing eight feet wide was placed between the edges of the concrete pavement and the three-foot concrete gutters. A three-foot, nine-inch concrete sidewalk was provided along one side of the underpass.

The two railroad tracks are carried over the highway on a ballasted deck through plate girder structure supported on reinforced concrete "U" abutments. The two steel girders are 76′ 6″ long and provide a clear span of 66′ 3″ normal to the highway. A total of 303,000 pounds of structural steel was used. The excavation slopes are protected with concrete slope paving throughout the underpass. The subway was built under contract by J. E. Haddock, Ltd.

PICO UNDERPASS

The contract for the Pico Grade Separation under the Union Pacific Railroad tracks, which has just been completed, included 0.49 mile of highway improvement from Whittier Boulevard to Beverly Boulevard. The total cost of this project was approximately $159,000. The new highway in the vicinity of the Pico Underpass is 76 feet wide between curbs and has a four-lane Portland cement concrete pavement 46 feet wide. The paving is extended to the three feet wide concrete gutter by a twelve-foot strip of plant-mixed surfacing along each side.

The highway through the underpass structure is 64 feet wide between curbs and is similar to the adjacent highway surfacing, except for the addition of a three-foot concrete sidewalk on each side and the reduction in width of the plant-mixed surfacing from twelve feet to six feet. The excavation slopes are protected by concrete slope paving for the entire length of the depressed portion of the roadway. A service road with a 25-foot plant-mixed pavement is provided along the east side of the underpass to serve the developed properties at that location.

The double tracks of the railroad are carried over the highway by a

(Continued on page 24)



Grade separation on State Sign Route 19 carrying Atchison, Topeka and Santa Fe railroad tracks over highway near Rivera.



Underpass beneath Southern Pacific near Rudell station on Rosemead Boulevard provides two 23-foot traffic lanes with 6-foot curbed dividing strip and two 3-foot concrete sidewalks.



Pico underpass beneath Union Pacific at Whittier Boulevard provides four traffic lanes in addition to 3-foot sidewalks on each side.

New Markers To Curb Speed On Curves Placed

TO HELP motorists in answering safely the question of what speed should be used on a curve ahead, State Highway Engineer C. H. Purcell announces the installation and testing of a new system of road markers designating speeds at which curves may be safely negotiated.

The new road markers, of the diamond-shaped caution type, will be placed just below standard curve signs. Both signs will be reflectorized.

Motorists have long depended on the reflectorized arrow to warn them of the type of curve ahead. The safe-speed sign will indicate "SLOW 30 MILES" or some other safe speed at which the curve can be driven safely under ordinary circumstances. All miles-per-hour signs will be in five-mile increments.

In announcing the test program Purcell stated that the question of posted safe speed limits has been under consideration as a safety measuse by the Division of Highways for some time. The accident records indicate a high percentage of driving-off-the-road and turning-over accidents as occurring at curves, the contributing factor being too much speed for the safe negotiation of the curve.

Safe speeds at curves will be carefully determined by expert drivers with the assistance of specially prepared equipment, said Purcell. The motoring public can greatly assist the Division of Highways by cooperating both in carefully complying with the recommended safe speed limits and in writing to the Division, indicating the reaction to the new safety markers.

Safe-speed curve markers will be placed immediately at many locations throughout the State. If the public will read roadway warning signs, these new markers should do much to cut down the accident toll of California.

Overheard on the Beach—"Mummy, may I go in for a swim?"
"Certainly not, my dear, it's far too deep."
"But daddy is swimming."
"Yes, dear, but he's insured."

"I hate people who are vague and noncommittal, don't you?"
"Mmmmmmm."



Safe speed signs being placed at curves in test program.

"HIGHWAYS OF TOMORROW" TOPIC OF A. R. B. A. CONVENTION

"Highways of Tomorrow" will be the keynote of the 36th annual convention and highway exhibit of the American Road Builders Association when that organization meets in San Francisco March 7-10, 1939. This will be the first conclave of the road builders in the west and it will be held concurrently with the national convention of the Associated General Contractors of America.

Charles Upham, engineer-director of the American Road Builders' Association, and Edward J. Harding, managing director of the Associated General Contractors of America, agreed that the concurrent meetings of the two associations will bring together representatives of the highway industry and profession from all parts of the nation, especially the western states, and will help immeasurably to solve many problems of the highway program.

Wife: "No, I didn't sew a button on your pants; I was too tired. Which is more important—your wife or your pants?"
Husband: "Well, there are places I can go without a wife."

Rosemead Boulevard Grade Separations Are Completed

(Continued from page 22)

ballasted deck through girder superstructure supported on reinforced concrete abutments. A total of 377,000 pounds of structural steel was placed. The two steel girders are 76′ 11″ long over all and have a depth of approximately nine feet. Each girder weighs 82,000 pounds.

The concrete abutments are of the "U" type, supported on spread footings. This project was constructed by the C. O. Sparks and Mundo Engineering Company.

The underpass under the Southern Pacific Railroad near Rudell Station was included in a 0.39 mile project consisting of 1300 lineal feet of depressed highway, 800 lineal feet of connection to the existing highway, and a two-span rigid frame steel structure with reinforced concrete abutments to support the railroad. A 24-foot service road was constructed along each side of the depressed highway to serve adjacent properties. This project cost approximately $128,000.

The new highway through the underpass is 80 feet wide between curbs and consists of two 23-foot uni-directional traffic ways of reinforced concrete pavement, separated by a central dividing strip, and curbs six feet wide. The concrete pavement is flanked on each side by an eleven-foot strip of plant-mixed surfacing and a three-foot concrete curb. Two three-foot concrete sidewalks are provided for pedestrian traffic. The 24-foot service roads are paved with plant-mixed bituminous surfacing.

The ballasted deck railroad structure provides two 41½-foot clear spans normal to the highway, is of modern rigid-frame design, and required 189,000 pounds of structural steel. The appearance of the structure is enhanced by the provision of reinforced concrete facia beams.

The drainage system of each of these subways included the installation of two electrically operated automatic pumps having a combined pumping capacity of approximately 1100 gallons per minute.

This contract was completed by the United Concrete Pipe Corporation.



California Nautical School

Operating Training Ship California State

November 9, 1938

California Highways and Public Works,
Sacramento, California.

Gentlemen:

For the past year I have been receiving the California Highways and Public Works publication and wish to express my appreciation for the opportunity to keep abreast of the activities in connection with our California highways.

I find the material contained highly instructive and well presented.

Thanking you for placing my name on your mailing list, I am

Very truly yours,

(Signed) CAPT. R. C. DWYER.

RCD:R

Gemeentelijke Technische Dienst Rotterdam

Rotterdam, 22nd September, 1938

Department of Public Works,
Public Works Building,
Sacramento.

Dear Sir:

The August issue of the periodical "California Highways and Public Works" contains an article on the tow service in connection with the San Francisco-Oakland Bay Bridge.

As for the Maastunnel at Rotterdam, a vehicular under-river tunnel now under construction, similar measures are planned, I beg to ask you for a number of details in connection with the said service.

Very truly yours,

THE CHIEF ENGINEER OF THE MAASTUNNEL,
J. P. VAN BRUGGEN.

Dear Sir:

I could use to great advantage your publication, "California Highways and Public Works" in my adult education classes, so I shall appreciate receiving it.

Most sincerely,

J. C. BROWER,
18 Hillside,
Fairfax, Cal.

Anderson Union High School

Anderson, California

Division of Highways,
P. O. Box 1499,
Sacramento, California.

Gentlemen:

Will it be possible to put the Anderson Union High School on your mailing list to receive copies of "California Highways and Public Works?"

The publication has definite educational value and could be used for reference work in several classes as well as for general reading purposes.

Yours very truly,

LAURENCE HARPER,
Principal.

California Highways and Public Works,
Sacramento, California.

Dear Sir:

I have read your publication, "California Highways," and think it is very instructive and educational. It is indeed a pleasure to read articles, written by men who know and are acquainted with the facts of highway problems.

I would appreciate having my name placed on the subscription list. I am employed by the county surveyor of Alameda County.

Yours very truly,

C. H. CLIFFORD.

Pittsburg Chamber of Commerce

10th and Los Medanos Streets.

November 11, 1938.

Mr. John W. Howe, Editor
California Highways and Public Works,
Sacramento, California.

Dear Mr. Howe:

Will you kindly add to your mailing list the:

High School Library,
Pittsburg, California.

Of all the literature received by us for counter use, none is more popular than your magazine, and I am sure it will be an appreciated addition to the reading table of the school library.

Very truly yours,

(Signed) JULIUS JORGENSEN,
Secretary.

Pasadena City Schools

Charles W. Eliot Junior High School,
2350 North Lake Avenue,
Altadena, California

November 9, 1938.

Division of Highways,
P. O. Box 1499,
Sacramento, California.

Dear Sirs:

Please place my name on your "California Highways and Public Works" magazine mailing list.

I teach in the above school, as conference counselor instructor, handling our guidance program for the eighth grade numbering 320 students.

Please send it to 370 Woodbury Road, Altadena, California.

Yours truly,

HERBERT S. CHESEBERG.

Appreciated by Liberia Engineer

Cape Palmas, Liberia,
West Africa,
October 25, 1938

California Highways and Public Works
Sacramento, California

Gentlemen:

Through my father, Gilbert H. Hogue, United States Bureau of Reclamation engineer, Friant, California, I have enjoyed the privilege of receiving your official journal for the past year.

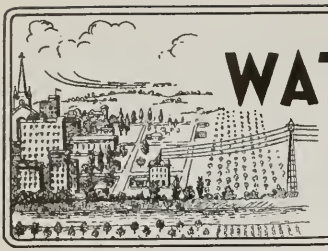
Please accept my congratulations for making available to the engineering profession so splendid a publication. As a construction engineer for the Republic of Liberia in conjunction with the Firestone Plantation Company, engaged entirely in road and bridge construction, each copy of "California Highways and Public Works" has been of much interest and assistance.

Particularly enjoyable was a recent issue showing in detail the damage to highways and bridges resulting from the spring flood, and describing the immediate and efficient manner in which highways were opened and damage repaired. Faced here in Liberia with the problem of handling an annual rainfall of 120 inches, most of which falling in five months, I can to some extent appreciate the fine highway organization now functioning in California.

Again, my congratulations on your splendid work and equally fine magazine.

Cordially yours.

(Signed) W. O. HOGUE,
Civil Engineer.



DIVISION OF WATER RESOURCES

OFFICIAL REPORT

FOR THE MONTH OF

November, 1938

EDWARD HYATT, State Engineer



THE filing of applications for allotments from money appropriated to the Emergency Fund by Chapter II, Statutes of 1938, Extra Session, for the restoration of property, levees, flood control works, county roads and bridges, damaged by the floods of the 1937-38 winter season throughout the State, has continued. The making of investigations and the preparation of reports on applications have also been continued, and more than 200 reports and recommendations have been prepared by the Division of Water Resources and State Reclamation Board and submitted to the Director of Finance, pursuant to his instructions. During the month no further allocations were made by Governor Frank F. Merriam for flood damage repair work. A total of $4,109,300 has been allocated for this work to date. The Division of Water Resources is performing some of the work for which these allocations were made, and the remainder is being done by the applicants under contracts entered into with the Department of Public Works. There are now 123 such contracts in force covering work which will cost $3,175,000.

IRRIGATION DISTRICTS

The El Dorado Irrigation District has purchased the Diamond Ridge Ditch System and plans rehabilitation of the canals and structures by means of a WPA project. A camp site near Placerville has been selected on which improvements will be made by State Relief Administration for housing about 200 men. Another project proposed by the District, including construction of storage on Sly Park Creek tributary to Cosumnes River, is now under investigation by the State Engineer.

La Mesa, Lemon Grove and Spring Irrigation District awarded a contract in the amount of $14,706 for installing the Fourth Unit in the District's pipe line replacement project which has been under construction during the past year. This will complete the program approved for replacing deteriorated water mains with cast iron pipe at a total estimated cost of $263,636.

SUPERVISION OF DAMS

The run-off from the last storm filled the Mad River Dam and water is now flowing over the crest. The dam itself is practically completed, there being some minor matters to be cleaned up prior to final completion.

At the present time work is being rushed to complete a number of construction jobs. These include Suttenfield, Lower St. Helena, Charles Lee Tilden Park, North Fork, and some work being done by the East Bay Municipal Utility District on Piedmont Reservoir No. 1.

WATER RIGHTS

Fifteen applications to appropriate water were received during October, 6 were denied, 24 were approved; 17 permits were revoked and the rights under 4 permits were confirmed by the issuance of licenses.

On October 1st progress reports were requested from 1242 permittees and on October 15th reports were requested from 571 licensees. These reports are being received daily and are in process of analysis.

TOPOGRAPHIC MAPPINGS.

Advance sheets of the Branch Mountain and the east half of Tobias Peak quadrangles are now available. The first sheet covers an area in San Luis Obispo and Santa Barbara counties. It is published on a scale of 1:48,000 with a contour interval of 50 feet. The east half of Tobias Peak quadrangle covers an area in Tulare and Kern counties. It is published on a scale of 1:96,000 with a contour interval of 100 feet.

SACRAMENTO-SAN JOAQUIN WATER SUPERVISION

The irrigation season is now complete and the rice and bean crops harvested. Sampling of water in the delta channels for salinity is being carried on at a number of stations.

The flow of the Sacramento River at Sacramento on November 22d was 9000 cubic feet per second; on October 22d the flow was 8500 cubic feet per second. The flow of the San Joaquin River at Vernalis on November 22d was 3900 cubic feet per second; on October 22d the flow was 2500 feet per second. These figures show the increase of these two streams at the end of the irrigation season.

CENTRAL VALLEY PROJECT

Engineering studies in connection with the Central Valley Project were continued. These studies included analyses of field data previously obtained through comprehensive hydrographic, hydrologic and topographic surveys, for the preparation of a report to be used in connection with negotiations for the acquisition of water rights of the lands bordering the San Joaquin River, which are now being served by that stream.

Negotiations were continued with public utility companies for the relocations of power and communication facilities for the complete project and for temporary relocations necessitated by construction activities.

FLOOD CONTROL AND RECLAMATION

The units of the flood control project under the care of this Department are now in fair condition for the next flood season. Routine maintenance has been carried on during this period.

The wave wash protection bulkhead at the southeast corner of Reclamation District No. 1660 in the Sutter By-pass is being rebuilt and is approximately 65 per cent complete at this time.

Relief Labor Work

An average of 125 laborers have been employed in clearing in the Feather River overflow channel, repairing the current retards at Nicolaus and constructing a wing dam at Robinson Bend. Fifty laborers have been employed continuously from the SRA transient camp in Sutter Basin. On account of the staggered work periods, this represents the labor of 100 men.

Emergency Levee Repair

The work of completing flood damage repairs in Glenn, Butte, Shasta and Tehama counties under Executive Order No. E 177 has been practically completed, the only work now under way being on Stony Creek, in Glenn County. The Chico office, which handled this work, has been discontinued.

The construction of a wing dam in the Feather River at Robinson Bend in Butte County is nearly completed.

Highway Bids and Awards for the Month of November, 1938

KERN COUNTY—Between 4 miles and 12 miles east of Mojave, about 7.6 miles to be graded and road-mix surface treatment and Class "B" seal coat applied. District IX, Route 58, Section A. Oilfields Trucking Co., Bakersfield, $35,997; Piazza & Huntley, San Jose, $36,188; Griffith Company, Los Angeles, $36,254; Dimmitt & Taylor, Los Angeles, $36,611; Martin & Schmidt Contractors, Long Beach, $37,454; Warren Southwest, Inc., Los Angeles, $38,409; Oswald Bros., Los Angeles, $40,215; C. R. Butterfield-Kennedy Co., San Pedro, $40,313; Clyde W. Wood, Los Angeles, $40,671; Young & Son Co., Ltd., Berkeley, $41,307; R. E. Hazard & Sons, San Diego, $42,248; R. M. Price, Huntington Park, $44,252; Basich Brothers, Torrance, $45,787; G. W. Ellis, North Hollywood, $46,953; R. L. Oakley, Pasadena, $48,859. Contract awarded to J. A. Casson, Hayward, $33,571.25.

LOS ANGELES COUNTY—At Big Tujunga Wash, about 0.5 mile to be graded and paved with Portland cement concrete and bank protection to be constructed. District VII, Route 9, Section L. A. Contracting Engineers Company, Los Angeles, $27,677; United Concrete Pipe Corp., Los Angeles, $29,280; Griffith Co., Los Angeles, $29,296; C. O. Sparks and Mundo Engineering Co., Los Angeles, $30,174; Matich Bros., Elsinore, $30,962. Contract awarded to Clande Fisher Co., Ltd., Los Angeles, $21,493.

LOS ANGELES COUNTY—Arroyo Seco Parkway between Hough Street and Meridian Avenue, about 0.8 mile to be graded and paved with Portland cement concrete, asphalt concrete, and plant-mixed surfacing, and two bridges to be constructed. District VII, Route 205, Section L.A., S.Pas. J. E. Haddock Co., Pasadena, $157,430; Griffith Co., Los Angeles, $161,633; W. E. Hall Co., Alhambra, $165,980; United Concrete Pipe Corp., Los Angeles, $168,987; C. O. Sparks & Mundo Engineering Co., Los Angeles, $177,772. Contract awarded to Claude Fisher Co., Ltd., Los Angeles, $154,870.15.

LOS ANGELES COUNTY—At San Martinez Chiquito Canyon, about 1.4 miles to be graded and paved with Portland cement concrete. District VII, Route 79, Section A. J. E. Haddock, Ltd., Pasadena, $70,711; Griffith Co., Los Angeles, $73,544; C. G. Willis & Sons Inc., & Chas. G. Willis, Los Angeles, $77,305; C. O. Sparks & Mundo Engineering Co., Los Angeles, $78,259; R. E. Campbell, Los Angeles, $78,356; S. Edmonson & Sons, Los Angeles, $83,737; United Concrete Pipe Corp., Los Angeles, $85,920; Hueser & Garnett, Glendale, $88,314; Johnston & Perscallo, Los Angeles, $93,714. Contract awarded to Matich Bros., Elsinore, $70,345.

ORANGE COUNTY—Doheny Park, at the mouth of San Juan Creek, about 0.15 mile, embankment protection to be constructed. District VII, Route 60, Section C. C. G. Willis & Sons, Inc., & Chas. G. Willis, Los Angeles, $35,724; S. A. Cummings, San Diego, $37,706; V. R. Dennis Construction Co., San Diego, $39,832; H. H. Peterson, San Diego, $41,952; R. M. Price, Huntington Park, $47,552; C. O. Sparks & Mundo Engineering Co., Los Angeles, $48,722; R. H. Travers, Los Angeles, $48,952. Contract awarded to R. E. Campbell, Los Angeles, $34,036.

ORANGE COUNTY—Between Sulphur Slide and Riverside County line, about 1.3 miles, portions to be graded and paved with Portland cement concrete and bank protection work to be constructed. District VII, Route 43, Section B. United Concrete Pipe Corp., Los Angeles, $138,670; Griffith Co., Los Angeles, $150,276; C. O. Sparks & Mundo Engineering Co., Los Angeles, $171,361; Oswald Bros., Los Angeles, $172,080; Heuser & Garnett, Glendale, $173,471; Johnston & Perscallo, Los Angeles, $195,186. Contract awarded to V. R. Dennis Construction Co., San Diego, $135,054.10.

SAN DIEGO COUNTY—A reinforced concrete slab bridge across San Luis Rey River, about 2 miles south of Rincon, consisting of eighteen 25-foot spans and two 8-foot 4-inch spans on cast-in-place concrete pile bents. District XI, Feeder road. V. R. Dennis Construction Co., San Diego, $43,856; Oberg Bros., Los Angeles, $42,969; S. A. Cummings, San Diego, $1,899; The Contracting Engineers Company, Los Angeles, $46,868; H. H. Peterson, San Diego, $42,239. Contract awarded to B. G. Carroll, San Diego, $40,120.

SANTA CLARA COUNTY—Between 1 mile east of Bells Station and 3 miles west of Merced County line, about 2.6 miles, to be graded and surfaced with gravel base and armor coat, and two reinforced concrete girder bridges to be constructed. District IV, Route 32, Section C. Heafey-Moore Co., Frederickson & Watson Construction Co., Oakland, $360,511; Bodenhamer Construction Co., Oakland, $378,984; Clyde W. Wood, Los Angeles, $383,380; Fredericksen & Westbrook, Sacramento, $396,918; Hemstreet & Bell, Marysville, $410,171; A. Teichert & Son, Inc., Sacramento, $423,294; Union Paving Co., San Francisco, $437,644; George K. Thompson & Company, Los Angeles, $462,257; Griffith Co., Los Angeles, $562,877. Contract awarded to Granfield, Farrar & Carlin, San Francisco, $355,731.60.

SANTA CRUZ COUNTY—Between one-half mile south of Davenport and Waddell Creek, about 8.2 miles to be graded and road-mix surface treatment applied. District IV, Route 56, Sections B, C. Hemstreet & Bell, Marysville, $271,412; Clyde W. Wood, Los Angeles, $293,280; Daley Corporation, San Diego, $335,678; Granfield, Farrar & Carlin, San Francisco, $236,811; Fredericksen and Westbrook, Sacramento, $237,647; Larsen Bros., Harms Bros. and H. Earl Parker, Sacramento, $242,384; Louis Biasotti & Son and Claude C. Wood, Stockton, $253,734; Heafey-Moore Co., Fredrickson & Watson Construction Co., Oakland, $260,335; A. Teichert & Son, Inc., Sacramento, $261,681; United Concrete Pipe Corporation, Los Angeles, $262,060; The Utah Construction Co., San Francisco, $277,336; Macco Construction Co., Clearwater, $289,877; Griffith Co., Los Angeles, $298,815. Contract awarded to N. M. Ball Sons, Berkeley, $232,492.30.

SISKIYOU, SHASTA, MODOC, AND LASSEN COUNTIES—At maintenance stations located at Mt. Shasta, Redding, Alturas and Susanville, 12 radio poles, each 100 feet long, to be erected. District II. Thomas Rigging Co., Oakland, $2,187; Edward Green, Los Angeles, $2,280; M. A. Jenkins, Sacramento, $3,288; A. A. Tieslau, Berkeley, $3,870; Underground Construction Co., Oakland, $4,740; A Young, Yreka, $5,760. Contract awarded to R. M. Taylor, Cottonwood, $1,992.

VENTURA COUNTY—Repairs to the bridge across Santa Clara River, at Bardsdale, to be constructed; and the roadway approach to be graded and surfaced with plant-mixed surfacing. District VII, Route 155, Section C. White & Wilberg, Santa Monica, $52,493; United Concrete Pipe Corp., Los Angeles, $53,288; Ralph A. Bell, Monrovia, $54,559; Gibbons & Reed Co., Burbank, $58,305. Contract awarded to Griffith Co., Los Angeles, $50,143.

VENTURA COUNTY—Reconstruction of a bridge across the Santa Clara River at Saticoy and approaches thereto. District VII, Route 9, Section A. Gibbons & Reed Co., Burbank, $112,410; United Concrete Pipe Corp., Los Angeles, $114,475; Oscar Oberg, Los Angeles, $117,663; Ralph A. Bell & Donald E. Metzger, Los Angeles, $119,500; White & Wilberg, Santa Monica, $123,409; The Contracting Engineers Co., Los Angeles, $132,552; Byerts & Dunn, Los Angeles, $138,273. Contract awarded to Paul J. Tyler, Oroville, $111,985.20.

Secretary Wallace Stresses Need of Reconstruction

Secretary of Agriculture Henry A. Wallace in an address at a dinner of the National Safety Council in Washington on April 12, 1938, said:

"We have a two-fold task—to rebuild highways as nearly accident proof as possible as rapidly as we can afford where these are badly overloaded by traffic, and at the same time not to overlook the thousands of miles of existing highways which must certainly continue into the distant future to carry a large part of our nation's travel.

"Much can be done to make these safely usable through the application of ingenious and intelligent engineering, persistent and comprehensive education, courteous, impartial, effective enforcement."

"Do you use tooth paste?"

"What for? None of my teeth are loose."

Contractor (in drug store): "I want to buy a plow."

Clerk: "I'm sorry sir, but we don't carry plows."

Contractor: "This is a heck of a drug store."

Small Boy: "Shine your shoes, mister?"

Grouch: "No!"

Small B: "Shine your shoes so you can see your face in them?"

Grouch: "No!"

Small B: "Coward!"

Widening of Rose Canyon Completed

(Continued from page 16)

with recessed panels, painted for reflection of light at night and strategically located openings for cross-overs. At Balboa Avenue, where the bulk of La Jolla traffic turns off, the curb separation was widened to sufficient width to provide an intermediate stopping zone between opposing streams of traffic, making it necessary to await a break in only one line of traffic at a time.

This section of divided highway connects directly with that crossing Torrey Pines Mesa and beginning at the north end of the project. This section of the Mesa has long been publicized and used as an example of ideal separation, and pictures of it have been used in highway publications throughout the country. Including this and the recently finished section, there is now a continuous section of divided highway extending for approximately fifteen miles over which there should be a minimum of accidents which are preventable by separation of opposing streams of traffic.

The work completed under the current contract involves major items in approximate quantities as follows: roadway excavation 175,000 cubic yards; imported borrow 30,000 cubic yards; overhaul 4,000,000 station yards; asphaltic concrete 30,000 tons; Portland cement concrete 13,000 cubic yards and other miscellaneous items, the total reaching an approximate cost of $380,000.

As outlined, the 9.7 miles from Barnett Avenue to Miramar Road have been developed over the period from 1929 to the present date by progressive projects, all designed to culminate in the ultimate result which we have today. This work is a splendid example of planning for current needs, using construction that can be expanded to take care of additional traffic as it develops, without the loss of preceding investments. The total cost of construction through the various stages over this period of years has been approximately $1,034,000 or slightly more than $100,000 per mile.

In Memoriam

Charles Arthur Marsh

C. A. Marsh, Supervising Right-of-Way Agent for Northern California, Division of Highways, passed away suddenly at his home in Berkeley on November 6th.

Mr. Marsh was born in Oakland, California, on February 26, 1887, and received his education in the Alameda and San Joaquin county schools. After finishing his education, he entered the employ of the Southern Pacific Company as a rodman in August, 1904. In 1911 he moved to the office of the Right-of-Way and Contract Agent in San Francisco and served successively as Assistant Industrial Agent and Land Appraiser.

In October, 1924, he entered the employ of the McMillan Oil Company at Long Beach as manager of the wholesale and retail distribution of petroleum products. Leaving there, he returned to San Francisco to James G. Stafford & Associates as Assistant Superintendent and Industrial Land Appraiser and appraised the heavy industrial area for the City and County of San Francisco and the county of Alameda.

On May 7, 1928, he entered the employ of the Division of Highways as Right-of-Way Agent, District IV, where he remained until June 1, 1933, when he assumed the duties of obtaining rights-of-way for the San Francisco-Oakland Bay Bridge project, including the interurban railroad, the bridge approaches and arterials leading thereto, a responsibility which may have been equalled but never surpassed in the history of the State of California.

On March 1, 1936, he was appointed Supervising Right-of-Way Agent for Northern California.

His high ideals, great ability and integrity, together with his unfailing courtesy and affability, endeared him to all with whom he came in contact.

San Rafael Bottleneck Broken

(Continued from page 12)

The contract for this project was approved on May 18, 1938, with the very short time limit of 150 working days, making it imperative that the work be prosecuted vigorously in order to complete the project within the allotted time.

The contractor A. G. Raisch, attacked the work from all possible points at the same time. Many operations were progressing simultaneously: grading, hauling imported borrow, placing asphalt and concrete surfacing, constructing drainage structures, and every other operation that could be carried on without conflict. Due to this, all major portions of the work were completed in advance of the seasonal rains in spite of the heavy traffic that was maintained with two usable lanes always open.

LA CUESTA GRADE OPENED

(Continued from page 17)

Merriam, Mayor Rossi, Mayor Bowron, Senator Jespersen and others.

Among the distinguished guests at the speakers' tables were: H. W. Saunders, vice president of the Oakland Chamber of Commerce; Ray Judah, chairman of the State Highway Commission; Harry Chandler, publisher of the Los Angeles Times; A. J. McFadden, president of the State Chamber of Commerce; J. R. Knowland, publisher of the Oakland Tribune; Alfred J. Cleary, chief administrative officer of San Francisco; George Hearst, publisher of San Francisco Examiner, representing W. R. Hearst; Earl Lee Kelly, director of the State Department of Public Works; Congressman A. J. Elliott, Mayor E. J. Leach of Salinas.

Customer: "I'd like some rat poison."
Clerk: "Will you take it with you?"
Customer: "No, I'll send the rats over after it."—*Maltcaser.*

Office Boy—Someone to see you sir, a gentleman with a mustache.
Absent-Minded Employer—I can't see him. Tell him I have one already.

STATE OF CALIFORNIA

Department of Public Works

Headquarters: Public Works Building, Twelfth and N Streets, Sacramento

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HARRY A. HOPKINS.....Assistant Director

EARL LEE KELLY.....Director
EDWARD J. NERON.....Deputy Director

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SAN FRANCISCO-OAKLAND BAY BRIDGE

C. E. ANDREW, Bridge Engineer

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CARLETON PIERSON, Supervising Specification Writer
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CLARENCE W. MORRIS, Attorney, San Francisco
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C. R. MONTGOMERY, Attorney
ROBERT E. REED, Attorney

DIVISION OF PORTS

Port of Eureka—E. S. MACKINS, Surveyor

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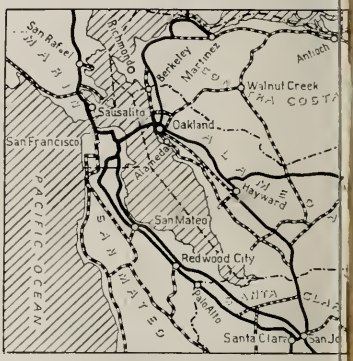
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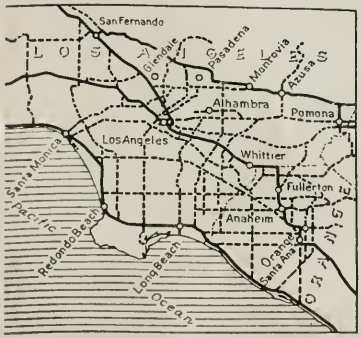
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MAP
SHOWING
STATE HIGHWAY SYSTEM

LEGEND
Primary Roads
Secondary Roads
Proposed Roads



SAN FRANCISCO AND VICINITY



LOS ANGELES AND VICINITY

See Detail Map

See Detail Map

Seattle Public Library